VOL. XXXVI. PART 12 DECEMBER, 1957

THE REVIEW OF APPLIED MYCOLOGY

Compiled from
WORLD LITERATURE ON PLANT PATHOLOGY AND APPLIED MYCOLOGY

RECENT PUBLICATIONS

TOBACCO DISEASES
With special reference to Africa
By J. C. F. Hopkins. 204 pp., 54 ½-tone plates, 5 col. plates, 1956. *Price* £1. 15*s.* post free

LOSSES CAUSED BY PLANT DISEASES IN THE COLONIES
By G. Watts Padwick. 60 pp., 28 figs., 1956. *Price* 10*s.* post free

WITCHES' BROOM DISEASE OF CACAO
By R. E. D. Baker and P. Holliday. 42 pp., 14 plates, 10 figs., 1957
Price 12*s.* 6*d.* post free

COMMON NAMES OF VIRUS DISEASES USED IN THE REVIEW OF APPLIED MYCOLOGY (1957)
[412 Viruses with Index.] *Price* 6*s.* post free

THE COMMONWEALTH MYCOLOGICAL INSTITUTE
KEW, SURREY

Price 6s. net

COMMONWEALTH MYCOLOGICAL INSTITUTE

EXECUTIVE COUNCIL: T. Swaminathan, I.C.S. (*Chairman*), India; J. G. Malloch, M.B.E., Ph.D. (*Vice-Chairman*), Canada; W. C. Tame, United Kingdom; A. Shavitsky, Australia; V. Armstrong, Ph.D., New Zealand; E. D. Andrews, Union of South Africa; C. K. Reheem, Pakistan; A. Perera, Ceylon; K. B. Asante (*Acting*), Ghana; J. E. C. Coventry, Federation of Rhodesia and Nyasaland; C. E. Lambert, C.M.G., Colonial Territories.

Secretary: Sir Herbert Howard.

STAFF: *Director and Editor*: J. C. F. Hopkins, D.Sc., A.I.C.T.A.; *Assistant Director*: H. A. Dade, A.R.C.S. *Mycologist*: E. W. Mason, O.B.E., M.A., M.Sc. *Assistant Editors*: G. C. Ainsworth, Ph.D., Grace M. Waterhouse, M.Sc. *Assistant Mycologists*: M. B. Ellis, Ph.D.; F. C. Deighton, O.B.E., M.A.; C. Booth, M.Sc.; Agnes H. S. Brown, Ph.D. *Sub-Editors*: E. B. Martyn, B.A., D. Jean Stamps, Ph.D. *Colonial Pool of Plant Pathologists*: R. A. Altson, B.Sc., A.R.C.S.; P. Holliday, M.A.; B. E. J. Wheeler, Ph.D.

SULPHATE OF COPPER

98/100% PURITY

CRYSTALS AND POWDER

FUNGUS DISEASES

Control and prevent by spraying with Bordeaux Mixture made with the best quality Sulphate of Copper.

COPPER DEFICIENCY

Sulphate of Copper in powder form is also widely used for the correction of Copper Deficiency of the soil and in animal nutrition.

BRITISH SULPHATE OF COPPER ASSOCIATION LTD.

1 GREAT CUMBERLAND PLACE, LONDON, W.1

Telegrams: Britsulcop, Wesphone, London

Telephone: Paddington 5068/9

A DICTIONARY OF THE FUNGI

By G. C. AINSWORTH and G. R. BISBY

Fourth edition now available: viii+475 pp., 10 plates, 20*s*., post free.

AN INTRODUCTION TO THE TAXONOMY AND NOMENCLATURE OF FUNGI

By G. R. BISBY

Second edition now available: vii+143 pp., cloth, 10*s*., post free.

MISCELLANEOUS PUBLICATIONS OF THE COMMONWEALTH MYCOLOGICAL INSTITUTE

No. 10. Bibliography of systematic mycology, 1952. 25 pp., 1953. *Price* 3*s*.
No. 11. Bibliography of systematic mycology, 1953–1954. 46 pp., 1955. *Price* 5*s*.
No. 12. The genus Phytophthora. Diagnoses (or descriptions) and figures from the original papers. *By Grace M. Waterhouse*, 120 pp., 66 pl., 11 figs., 1956. *Price* 15*s*.
No. 13. Bibliography of systematic mycology, 1955. 32 pp., 1956. *Price* 5*s*.
No. 14. Bibliography of systematic mycology, 1956. 33 pp., 1957. *Price* 5*s*.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD, BY CHARLES BATEY, PRINTER TO THE UNIVERSITY

COMMONWEALTH MYCOLOGICAL INSTITUTE

REVIEW OF APPLIED MYCOLOGY

VOL. XXXVI DECEMBER 1957

C. A. B.
1 JAN 1958
FILE

Literature references in [ ] refer to the *Review of Applied Mycology*. Map references are to the C.M.I. distribution maps of plant diseases.

Jahresberichte der Pflanzenschutzämter 1955. [Annual reports of the Plant Protection Bureaux 1955.]—228 pp., Biologische Bundesanstalt für Land- und Forstwirtschaft, Braunschweig, 1956.

This volume comprises the annual reports of the Plant Protection Bureaux of the ten constituent provinces of the German Federal Republic, including Berlin, presented as before [cf. 35, p. 416].

BIEBER (J.) & WARTENBERG (H.). **Untersuchungen der Sekundärtumoren beim bakteriellen Pflanzenkrebs an Helianthus annuus.** [Studies of secondary tumours in bacterial crown gall of *Helianthus annuus*.]—*Ber. dtsch. bot. Ges.*, 70, 6, pp. 205–216, 9 figs. on 1 pl., 1957.

At the Institute for General Botany, Friedrich Schiller University, Jena, the authors studied gall development in *H. annuus* [cf. 34, p. 216] following inoculation with *Pseudomonas* [*Agrobacterium*] *tumefaciens* at a point on the stem where active elongation had ceased. In addition to the primary gall at the site of inoculation there developed secondary galls on the petioles higher up the stem. These resulted from hypertrophy and cell division in the parenchyma adjacent to the xylem, followed by the development of a gall meristem, connected to a greater or lesser extent with the cambium of the vascular bundle, which produced some vascular elements and then proliferated to form small-celled gall tissue. The stimulus for the gall formation was considered to have diffused from the vascular bundle, which assumption would also explain the development of swellings at irregular intervals on the stem above the inoculation site, resulting from hypertrophy and limited cell division of pith cells adjacent to the bundles.

Another type of secondary developed in the immediate neighbourhood of the primary gall by proliferation of the cortical parenchyma.

In yet another type of gall, developing from stem fissures, wound stimulus appeared to play a role.

MCKAY (R.). **Cereal diseases in Ireland.**—ix+161 pp., 7 col. pl., 90 figs., Dublin. At the Sign of the Three Candles, 1957. 21*s*.

This book, intended primarily for the identification of the commoner cereal diseases in Ireland, is copiously illustrated from specimens received by the Plant Pathological Division, University College, Dublin. A few references are included after the account of each disease, which includes the life-history of the pathogen and control measures. In an appendix, the common barberry and the buckthorns (*Rhamnus cathartica* and *R. frangula*) are described, and in conclusion there is a summary of control measures, a glossary, and an index.

Hinke (F.). **Der Schwarzrost des Getreides und seine Bekämpfung.** [Black rust of cereals and its control.]—*Prakt. Bl. PflBau.*, 52, 1, pp. 3–28, 2 col. pl., 3 figs., 1 map, 1957.

This is a more detailed account of the eradication of barberry in Bavaria to control *Puccinia graminis*, already noticed [35, p. 431].

Gustavsson (A.). **Rasinventering av stråsädesrost.** [Drawing up an inventory of cereal rusts.]—*Växtskyddsnotiser, Stockh.*, 21, 3, pp. 39–41, 1 fig., 1957.

Most of the samples of rusted cereals analysed at the Plant Protection Institute, Svalöv, Sweden, for the identity of the physiologic races [32, p. 306] of the pathogens originated in Götaland. Two nearly related races of black rust [*Puccinia graminis*], 21 and 34, predominated in the 79 wheat samples, while 3 others were sparsely distributed. Race 21, apparently one of the most widespread in Europe, also occurred in 2 samples (1 of barley) from Finland [34, p. 440].

Race 77 of wheat brown rust [*P. triticina*: 32, p. 11] was harboured by nearly half the 255 samples in the collection, which yielded about 5 races altogether.

Four races of black rust [*P. graminis*] were differentiated on oats, viz., 3, 4, 6, and 7. At least 1 of them, a variant of 6, which is possibly confined to Sweden, may be difficult to control by selective methods, since it attacks all the varieties hitherto tested, besides the 4 comprising the standard assortment.

Some 15 races of crown rust of oats [*P. coronata*] were identified in 64 samples, with 228 and 231 predominating.

Suneson (C. A.) & Ramage (R. T.). **Studies on the importance of the yellow-dwarf virus.**—*Agron. J.*, 49, 7, pp. 365–367, 1 fig., 1957.

In field tests carried out jointly by the Department of Agronomy, University of California, and the Field Crops Research Branch, United States Department of Agriculture, over a period of six years, controlled mass infections of cereals with the [barley] yellow dwarf virus [33, p. 74] were obtained by pulling or cutting diseased host plants, transporting them to the test plots, and then shaking off the aphids over the test area where the aphids were allowed to feed at random on the test material. Average yield reduction in early sown tests was 26 per cent., but 80 per cent. was obtained in certain varieties in the late sown test. Barley, oats, and wheat were equally susceptible, although California-grown barley showed more resistance than the North American barleys in general.

It is suggested that breeding for resistance either to aphids or to the virus is necessary for minimizing crop losses and that extensive testing experience with local crop varieties is required for a precise identification of the disease in the field.

Johnston (C. O.) & Huffman (M. D.). **Physiologic races of the leaf rust of Wheat in the United States in 1955.**—*Plant Dis. Reptr*, 41, 2, p. 115, 1957.

In 285 collections of *Puccinia rubigo-vera* f.sp. *tritici* [*P. triticina*] received at the Kansas Agricultural Experiment Station, Manhattan, from 30 States, 22 races were identified in 1955 [cf. 35, p. 431]. Race 5 was the most prevalent, comprising 26·9 per cent. of the 933 isolates, followed by races 105 and 15. There was a marked increase in the prevalence of race 6.

Hassebrauk (K.) & Kaul (R.). **Vergleichende chemische Untersuchungen des Atmungsstoffwechsels von Weizenkeimpflanzen unterschiedlicher Braunrost-anfälligkeit.** [Comparative chemical studies on the respiration metabolism of Wheat seedlings of divergent susceptibility to brown rust.]—*Phytopath. Z.*, 29, 3, pp. 305–326, 1 fig., 1 diag., 4 graphs, 1957.

Studies are reported from the Institute for Physiological Botany, Brunswick, Germany, to elucidate the problem of differential susceptibility to *Puccinia triticina*

in wheat seedlings [cf. 35, p. 597]. The material used consisted of the highly susceptible Michigan Amber; *Triticum monococcum* var. *hornemanni*, very resistant to both *P. triticina* and yellow rust [*P. glumarum*]; Brevit (*a*) normally illuminated and (*b*) exposed to the light for only six hours daily (which tends to reduce both resistance and severity of infection in this variety); and Strubes Dickkopf (*a*) untreated and (*b*) supplied with iodo-acetic acid (10^{-3} N) in the nutrient solution, which enhances the already existing susceptibility of the variety.

The following results were obtained. The activity of the cytochrome system was extraordinarily slight compared with that of the ascorbic acid [vitamin C] oxidase. Polyphenolase was apparently absent. The activity of both systems was higher in plants with reduced or not yet enhanced liability to infection by *P. triticina*.

There was an increase in the sugars acting as materials of intermediate metabolism in the more susceptible plants, whereas the acids were present in approximately equal amounts in all.

The activity determinations of the enzyme systems and paper-chromatographic analyses of sugars and acids suggest that metabolism proceeds more rapidly in plants with little tendency to brown rust infection.

Substances with key positions in the endoxidation system, such as vitamin C and various phenols, occur in significantly larger amounts in the resistant *T. monococcum* var. *hornemanni* than in the highly susceptible Michigan Amber. In Brevit their content diminishes with the withdrawal of light. The iodo-acetic acid treatment of Strubes Dickkopf produced a slight increase of the key substances. Since the withdrawal of light from Brevit frequently induces a coincident reduction of resistance and mitigation of the virulence of brown rust attack, it may possibly be inferred from the experimental data that the type of resistance and intensity of infection are two aspects of the disease picture regulated by different metabolic processes. Thus, one of the factors concerned in the degree of infection is the sugar content of the host, while the proportions of vitamin C and phenols are probably implicated in the expression of the infection type.

Powers (H. R.) & Sando (W. J.). **Genetics of host-parasite relationship in powdery mildew of Wheat.**—Abs. in *Phytopathology*, 47, 7, p. 453, 1957.

Studies were made of the relationship between two independent, dominant genes conveying mildew resistance in wheat and two genes for virulence in *Erysiphe graminis* [cf. 36, pp. 394, 459]. Normandie wheat, carrying the genes Ml_t and Ml_u for resistance, was crossed with Little Club, having recessive alleles. The cultures of *E. graminis* used were 116–3, virulent against Ml_t but not Ml_u, and 116–2, the reverse. Normandie was resistant and Little Club susceptible to both. Plants of F_2 and F_3 from the wheat cross were inoculated with both cultures to identify the four possible homozygous genotypes of the host, which were then used to identify the four possible haploid genotypes from a cross between the pathogen cultures. These proved to be the two parental types, a third more virulent than either of these, attacking Normandie, and a fourth only attacking Little Club. The third therefore contained both genes for virulence and the fourth neither, indicating that for each gene Ml_t and Ml_u in the host a complimentary gene for virulence exists in the pathogen.

Tuite (J. F.) & Christensen (C. M.). **Grain storage studies. XXIV. Moisture content of Wheat seed in relation to invasion of the seed by species of the Aspergillus glaucus group, and effect of invasion upon germination of the seed.**—*Phytopathology*, 47, 6, pp. 323–327, 1 fig., 1957.

Further studies at the University of Minnesota, St. Paul [36, p. 685] concerned the invasion of stored wheat at varying moisture content by *Aspergillus amstelodami*, *A. repens*, *A. ruber*, and *A. restrictus*. Wheat seed of 12·2–16 per cent.

moisture content was inoculated and then held for 1 to 15 months over suitable salt solutions giving relative humidities of 65, 71, 76, and 80 per cent. *A. restrictus*, especially pathogenic, and *A. amstelodami* invaded the seed gradually (within about six months) at a moisture content of 13–13·6 per cent., at which *A. repens* and *A. ruber* parasitized it more slowly. At 14·3–14·6 per cent., *A. repens* invaded more rapidly during the first two months, but two months later all four species had invaded all of the seed. At 15·5–16 per cent. there was 100 per cent. infection by all the species within a month. Sterilization of the seed with 1 per cent. sodium hypochlorite at the start of the experiment was shown not to increase susceptibility to the fungi. Invasion by the fungi, especially of the embryo by *A. restrictus*, caused a marked reduction in germination, reducing it to below 50 per cent. within four months. It would appear that for long storage periods wheat should not be held at over 13 per cent. moisture content, although 14 to 14·5 is permitted at present.

Staples (R.) & Allington (W. B.). **Streak mosaic of Wheat in Nebraska and its control.**—*Res. Bull. Neb. agric. Exp. Sta.* 178, 40 pp., 12 figs., 4 graphs, 1956.

Following a description of the symptoms of wheat streak mosaic virus [36, p. 389], the biology of its vector (*Aceria tulipae*), and epidemiological studies in Nebraska in 1953 and 1954 a number of control measures are proposed. It is important to destroy early volunteer wheat plants which emerge soon after harvest and provide a continuity of food for *A. tulipae* during the summer months. Hail storms before harvest remove some of the kernels which are able to germinate prematurely. Viruliferous mites are mainly dispersed by wind, and high temperatures in the autumn increase the time of exposure of the crop. Winter wheat should be planted as late as possible. Infection early in the growing period causes the most damage. Native annual and perennial grasses were unfavourable as hosts for *A. tulipae*. The application of insecticides to the wheat crop in the autumn is not considered practicable.

Patterson (F. L.), Shands (R. G.), & Dickson (J. G.). **Temperature and seasonal effects on seedling reactions of Barley varieties to three races of Puccinia graminis f.sp. tritici.**—*Phytopathology*, 47, 7, pp. 395–402, 2 figs., 1957.

Data are presented of the seedling and adult reactions of 52 barley varieties at Wisconsin Agricultural Experiment Station, Madison, to three races of *Puccinia graminis* f.sp. *tritici* (nos. 17, 19, and 56) [cf. 27, p. 561; 33, p. 419] under a varied environment, and to an isolate of *P. graminis* f.sp. *secalis* [cf. 34, p. 592]. Inoculated plants were kept at 16°, 20°, 24°, and 28° C., and the resistant Valentine and susceptible Rabat were included in all the series.

Tested with *P. graminis* f.sp. *tritici*, seedling-reaction types on barley were not as distinct as on wheat. The incubation period was longest (averaging 12·2 days) at 16° and then progressively shorter at higher temperatures, averaging 6·7 days at 28°, temperatures above which were unfavourable for both host and parasite. Pustule size in general decreased with temperature, and differences between resistance and susceptibility were more clear at higher temperatures; reactions in winter differed somewhat from those in spring and autumn, in which latter seasons resistance tended to be greater. Reduction of day length and light intensity resulted in slightly decreased susceptibility in Rabat, but had no effect on the resistance of Valentine. Differences in seedling response to the races were small. In general seedling reactions at 28° agreed with adult-plant reactions in field or greenhouse.

Tyner (L. E.). **Factors influencing the elimination of loose smut from Barley by water-soak treatments.**—*Phytopathology*, 47, 7, pp. 420–422, 1957.

Further studies at the Canada Department of Agriculture, Edmonton, Alberta,

on the control of loose smut (*Ustilago nuda*) of barley by water treatments [34, p. 590; 36, p. 10] showed that to obtain control by soaking, the minimum weight of water to be added must equal 20 per cent. of the seed, followed by incubation for 48 hours at 70–75° F., which probably activates the physiological processes of germination (of which there is no visible evidence, but oxygen consumption increases markedly after addition of this much water) and establishes conditions necessary to eliminate the smut.

If Glacier barley was soaked in water for periods of ½, 1, 1½, 3, and 6 hours, during which it absorbed 14, 16·6, 18·2, 23·4, and 30·5 per cent. water, respectively, and was then drained and sealed in pliofilm bags for periods up to 48 hours, these did not give control, but after 72 hours in the bags, following soaking for three to six hours, complete control resulted.

In another experiment equally effective control was obtained by immersing seed in running water for 54 hours as in standing water for the same period, which suggests that control is dependent upon an agent within the seed, rather than upon micro-organisms or chemical products accumulating in the soak water.

Addition of chloranil to the water shortens the control period [loc. cit.]; furthermore, soaking in water sterilized after wheat germ had been fermented in it, and which was shown to contain quinones, gave control. This suggests that quinones formed in the germ of wheat or barley during fermentation may be the fungitoxic agents.

Skoropad (W. P.). **An improved method of inoculating Barley leaves with Rhynchosporium secalis.**—*Phytopathology*, 47, 7, p. 445, 1957.

Inoculation of barley leaves with *Rhynchosporium secalis* [36, p. 395] was conveniently achieved at the Plant Pathology Laboratory, Edmonton, Alberta, by using sporulating cultures obtained either from dormant mycelium on barley leaves floated on water in Petri dishes, or on malt-yeast agar. Conidia mixed with soft agar are then touched onto the leaf where required, the plants being subsequently kept moist either by water sprays or under polythene bags.

Jacquet (P.), Leben (C.), & Arny (D. C.). **Organic acids and the control of two seedling blights by the water-soak method.**—*Phytopathology*, 47, 6, pp. 377–378, 1957.

In further studies at the University of Wisconsin, Madison, on the control of *Helminthosporium victoriae* and *H. sativum* [*Cochliobolus sativus*] seedling blights of oats and barley, respectively, by water soaking [36, pp. 10–11], a synthetic acid solution was prepared containing approximately the amount of organic acids found in filtrates from soaked seed in the previous experiments. The efficacy of this solution in controlling the diseases was dependent on concentration, pH, duration of soaking, and temperature. Treatment periods of 56 hours at 2° C. gave control at concentrations 5 and 10 times that in the filtrates at pH 5; over 24 hours 10 times at pH 5 or 20 at pH 6 were needed; for 4 hours only, 20 or 40 times at pH 5 or 6. Lowering of the pH is, however, accompanied by increased phytotoxicity. Control was considerably more effective with *H. victoriae* and oats than with *C. sativus* and barley.

Pringle (R. B.) & Braun (A. C.). **The isolation of the toxin of Helminthosporium victoriae.**—*Phytopathology*, 47, 6, pp. 369–371, 1957.

At the Rockefeller Institute for Medical Research, New York, the writers isolated the toxin of *Helminthosporium victoriae* which induces the blight symptoms in oats [35, p. 10]. The toxic substance was obtained from the fungus grown in shallow layers in modified Fries's [18, p. 335] No. 3 basal medium at 25° C. for 28 days. The filtrate was then acidified, concentrated *in vacuo* to one-tenth, and inert

material precipitated with methanol. This in turn was evaporated off and the toxin extracted into butanol and purified by chromatography on columns of alumina and starch.

Toxin concentration was bioassayed by observing the extent of inhibition of root growth caused after 48 hours at 25° C. in germinating oat seeds of a susceptible variety (Park C.I. 6611) from which the hulls had been removed, and comparing the highest dilution that reduced root growth to 1 cm. or less as compared to 5 or 6 cm. in the controls. The toxin was extremely powerful, and inhibited the growth of susceptible oat roots at 0·01 μgm. per ml. Its biologically active constituent appears to be of a polypeptide nature.

Tsuimbal (M. M.). Полосатая пятнистость Ячменя и борьба с ней в степи УССР. [Leaf stripe of Barley and its control in the Ukrainian steppes.]—Земледелие [*Zemledelie, Moscow*], 5, 7, pp. 87–88, 1957.

In the steppes of the Ukraine leaf stripe of barley (*Helminthosporium gramineum*) is extremely serious, especially on Europeum 353/133, the most resistant variety being Odessky 09. Fertilizer treatment with nitrogen, phosphorus, and potassium (each 45 kg. per ha.) decreased infection from 37·7 to 33·1 per cent. [cf. **36**, p. 463]. The disease develops very rapidly if seed is kept under humid conditions; any seed with more than average moisture should be dried immediately after harvest.

Treatment with granosan (1·5 gm. per kg. seed) reduced infection from 12·9 (untreated) to 0 per cent. and with formalin (1 in 300) to 5·8 per cent. The same treatments reduced bunt [*Tilletia* sp.] from 3·6 (untreated) to 0·1 and 0 per cent., respectively. In 1948 the incidence of *H. gramineum* was reduced from 7·3 per cent. (untreated) to 1·1 per cent. when the seeds were treated at 28° to 32° [C.] for four hours followed by 52° for eight mins. and to 0·2 per cent. after three hours at 45°.

St. Garay (A.). **Role of fumarate in formation of stromata in 'vernalized' ergot fungus.**—*Science*, **126**, 3267, p. 263, 1957.

Warburg respiration studies at the Research Institute of Medicinal Plants, Budapest, Hungary, showed the respiration of sclerotia but not that of stromata of rye ergot (*Claviceps purpurea*) [**36**, p. 20] to be depressed by fumarate (which it is stated inhibits the germination of sclerotia pretreated by exposure to 0–3° C. for 6 weeks), an effect antagonized by succinate. It is, therefore, concluded that respiration follows different pathways in the two organs.

Verderevski (D. D.) & Voitovich (K. A.). О перспективах применения химического метода в борьбе с пузырчатой головней Кукурузы. [Perspectives of applying chemical method in control measures against blister smut of Maize.]—Докл. Акад. Сельскохоз. Наук Ленина. [*Rep. Lenin Acad. agric. Sci.*], 22, 4, pp. 18–22, 1957.

Secondary infections of maize smut (*Ustilago zeae*) [*U. maydis*: **35**, p. 602], according to observations in U.S.S.R., are more severe than primary. The authors state that sprays combining herbicidal and fungicidal qualities are the most effective, and they recommend the use of 1 per cent. Bordeaux mixture when prophylactic measures have failed.

Ullstrup (A. J.) & Miles (S. R.). **The effects of some leaf blights of Corn on grain yield.**—*Phytopathology*, 47, 6, pp. 331–336, 1957.

Studies by Purdue University, Lafayette, Indiana, with the United States Department of Agriculture, during 1948–55, concerned the effects of leaf infection of maize by *Helminthosporium turcicum*, *H. maydis*, and *H. carbonum* on the grain yields of maize varieties resistant and susceptible to these fungi. Resistance to *H.*

turcicum and *H. maydis* is dependent on several genes [31, p. 550; 34, p. 146], that to *H. carbonum* on one dominant gene [26, p. 448]. With the first two pathogens a number of resistant and susceptible single- and double-cross hybrids were used, with *H. carbonum* only one resistant and one susceptible cross. Disease effect was calculated by subtracting the difference in yield between non-inoculated and inoculated susceptible hybrids from that between the corresponding resistant hybrids. Artificial epiphytotics were created either by repeated inoculations (as described by Elliott and Jenkins [26, p. 11]) with spore suspensions introduced into the whorls of the plants with a compressed air sprayer, or by placing a very susceptible hybrid adjacent to the plots and inoculating this only.

The extent to which disease developed depended more on secondary than primary infection and this in turn was largely influenced by the weather. With a severe epiphytotic of *H. turcicum*, developing two to three weeks after tasseling, the most resistant hybrid yielded over 70 bushels per acre more than the most susceptible, and under these conditions each resistant inbred line substituted into the double-cross hybrids resulted in an average yield increase of 15 bushels per acre. When, however, the weather militated against heavy secondary infection until the crop was nearly mature (six or eight weeks after tasseling), resistance made little difference.

Comparable results were obtained with *H. maydis*, each increment of resistance in the pedigree increasing yield some 5·4 bushels per acre. With *H. carbonum* one severe epiphytotic resulted in a yield of 94 bushels per acre from the resistant hybrid as compared to 19 from the susceptible, the two yielding much the same in the absence of the disease.

MESSIAEN (C. M.) & LAFON (R.). **Les champignons nuisibles aux semis de Maïs. I. Organismes responsables et conditions d'infection.** [The fungi harmful to Maize plantings. I. Organisms responsible and conditions of infection.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 8, 1, pp. 111–126, 4 figs., 1957.

In a study at the Station of Plant Pathology, Centre of Agricultural Research of the South-West, Pont-de-la Maye, Gironde, France, of fungi causing failure to germinate in maize seed in south-western France [cf. 34, p. 780], the authors devised a method of testing for soil-borne fungi. Maize seeds were incubated at 10° C. in various soils, re-sown after one week on vermiculite in the greenhouse, and isolations made from the non-germinated seeds and sickly seedlings. The seeds were mechanically abraded to increase their susceptibility to infection. Most of the local soils were found to contain fungi harmful to maize, especially *Gibberella zeae* [cf. 33, p. 707].

FISHER (FRAN[CENIA] E.). **Control of Citrus fruit russet in Florida with zineb.**—*Phytopathology*, 47, 7, pp. 433–437, 2 figs., 1957.

In trials conducted by the Citrus Experiment Station, Lake Alfred, Florida, on some 200 acres of citrus in 1954–6, with a series of sprays, it was found that a single application of zineb in July or early August successfully controlled russet of citrus fruit. This suggests that russet may not be due to the rust mite, *Phyllocoptruta oleivorus*, as hitherto generally believed, but to a fungus, such as *Cladosporium brunneo-atrum* [cf. 18, p. 671], the cause of false melanose in Australia, and which was found on russeted fruit in Florida. The possible direct or indirect action of zineb on the rust mites, however, calls for further consideration.

MCCLEAN (A. P. D.). **Virus infection in Citrus trees.**—*F.A.O. Pl. Prot. Bull*, 5, 9, pp. 133–141, 1957. [36 refs.]

In this part of a report on a visit in 1956 to Ghana, Brazil, Florida, Texas, California, and Israel, the author reviews the present state of knowledge on virus

diseases of citrus. The subjects covered include the world distribution of these diseases, their occurrence and spread in commercial varieties, control, and economic importance, further sections dealing separately with psorosis, tristeza [see next abstract], exocortis, xyloporosis, vein enation, and stubborn disease.

REICHERT (I.) & BENTAL (A.). **Additional tristeza-infected Citrus varieties found in Israel.**—*F.A.O. Pl. Prot. Bull.*, 5, 8, pp. 129–130, 2 figs., 1957.

Further indexing on Egyptian-sown lime has revealed the presence of tristeza virus in Ellendale, Beauty of Glen-Retreat, Cape Naartje Platskill, Emperor, Oneco, and Fewtrell's Early mandarin, Paperrind St. Michael sweet orange, and Wheneey grapefruit in Israel [36, p. 22]. All eight varieties were introduced from abroad over 20 years ago, since when they have been grown exclusively in experimental collections, and none has ever shown any symptoms of the disease. There appears to be no efficient insect vector locally [36, p. 100]. So far, no local clone or commercially grown citrus variety in Israel has been found infected.

STEWART (R. B.). **Leaf blight and stem dieback of Coffee caused by an undescribed species of Ascochyta.**—*Mycologia*, 49, 3, pp. 430–433, 1 fig., 1957.

In September, 1954, coffee at the Jimma Agricultural Experiment Station, Ethiopia, developed a leaf necrosis and die-back of the young branches. The organism responsible attacks trees of any age, but seedlings and three- to four-year-old transplants appear to be most severely affected. The disease is most prevalent in excessive shade. The fungus, which is named *Ascochyta tarda* n.sp., has brown pycnidia measuring 70 to 110 μ in diameter. The mature spores are oval to short-cylindrical, 1-septate, straight, and 9–14 by 2–3 μ; they usually occur late in the life-cycle. The immature spores may be predominantly or entirely aseptate, are oval, and 4–9 by 2–3 μ. A closely associated species of *Mycosphaerella* (not *M. coffeicola*) was frequently found in natural infections. The brownish-black perithecia measure 60–90 by 60 by 75 μ, the asci are 25–45 by 7·5–12 μ, and the ascospores, inequally 1-septate, sometimes almost comma-shaped, 12–15 by 4·5–7·5 μ. There appeared to be marked varietal differences in resistance.

BITANCOURT (A. A.). **As fermentações e podridões da cereja de Café.** [The fermentations and rots of the Coffee 'cherry'.]—*Bol. Suptda Serv. Café, S. Paulo*, 22, 359, pp. 7–14, 2 figs., 2 graphs, 1957.

No qualitative or quantitative relationship could be demonstrated between the microflora of coffee berries and their provenance in different parts of the State of S. Paulo, Brazil, the time of maturity, or the degree of desiccation. The most prevalent species were *Colletotrichum gloeosporioides* or *C. coffeanum* [*Glomerella cingulata*: 26, p. 219], *Fusarium* (?) *concolor* [20, p. 402], and *Penicillium* spp., while others included *Aspergillus niger*, *Cladosporium* sp., *Rhizopus nigricans* [*R. stolonifer*], *Phomopsis* sp., and *Epicoccum* sp.

WELLMAN (F. L.). **Blister spot of Arabica Coffee from virus in Costa Rica.**—*Turrialba*, 7, 1–2, pp. 13–15, 2 figs., 1957. [Spanish summary.]

Blister spot, a new disease of *arabica* coffee believed to be of virus origin, is described from Costa Rica, where it was first found on coffee growing in dry, medium high, hilly areas and later also in the wetter, lower regions. The disease is characterized by yellowish, round, convex, and blister-like spots on young leaves, becoming larger (1 to 3 mm. in diameter) and coalescing in the older. Growth is somewhat stunted, internodes shortened, flowers few in number and setting very few fruits, which are generally smaller than in healthy plants. Many of them turn black towards the terminal half of fruit branches and develop round, slightly sunken lesions. An examination of the affected tissues revealed no fungi or bacteria. The

disease, which spreads in the field and is transmitted by *Toxoptera aurantiae*, was graft transmissible. Trials of seed transmission or leaf rubbing techniques with several hosts have so far been unsuccessful.

Naim (M. S.) & Hussein (A. M.). **Effect of the rhizospheric microflora on the growth of Cotton plants.**—*Sci. Bull. A' in Shams Univ., Cairo*, 1, pp. 77–95, 1956.

In experiments on cotton wilt (*Fusarium oxysporum*) [cf. 36, p. 295] at A' in Shams University, Cairo, three organisms (*Bacillus subtilis*, *B. lichniformis*, and *Aspergillus terreus*) from the rhizosphere of cotton were found to stimulate the growth of cotton seedlings of the varieties Giza 26, Karnak, and Ashmonni when inoculated into sterilized soil.

Naim (M. S.). **Cultural studies on a Fusarium sp. causing Cotton wilt in Egypt.**—*Sci. Bull. A' in Shams Univ., Cairo*, 1, pp. 57–74, 1956.

A *Fusarium* species causing cotton wilt and isolated from Giza 26 seedling is considered to be new. It differs from known species mainly in the production of sclerotia on Richards's solution agar and in producing pigment only on rice meal.

Conidial chlamydospores are also commonly produced. Microconidia are 16·2 by 3·6 (non-septate) to 19·3 by 3·6 μ (1-septate). Macroconidia are 25 by 3·6 (non-septate) to 37·5 by 3·6 μ (3-septate).

Bird (L. S.), Ranney (C. D.), & Watkins (G. M.). **Evaluation of fungicides mixed with the covering-soil at planting as a control measure for the Cotton seedling-disease complex.**—*Plant Dis. Reptr*, 41, 3, pp. 165–173, 1957.

Fungicides mixed with the covering soil at sowing were tested in the field on sandy and clay soils by the Texas Agricultural Experiment Station in 1955 and 1956 for control of the cotton seedling disease complex [cf. 35, p. 14; 36, p. 469], caused by soil-borne fungi such as *Rhizoctonia* [*Corticium*] *solani*, *Fusarium* spp., and *Pythium* spp., from which an average of 2·17 per cent. of the potential Texas cotton crop is estimated to have been lost each year during 1952–56.

No fungicide, either alone or in combination, gave uniformly good results on all the soil types though some were partially effective in controlling the disease. The better preparations (which, except for vancide 51 and dithane D-14, were usually mixtures) reduced attack by *C. solani* and *Pythium* spp. but increased the activity of *Fusarium* spp. [loc. cit.] as indicated by plating infected seedlings.

Schimitschek (E.). **Kleine Beobachtungen über Insektenkrankheiten.** [Brief observations on insect diseases.]—*Sydowia, Beih.* 1, pp. 250–254, 2 pl., 2 figs., 1957.

During the winter of 1954–5, 42 per cent. of the overwintering pupae of *Boarmia bistortata*, a parasite of larches in Schleswig-Holstein, Germany, were destroyed by *Isaria farinosa* [34, p. 785], numerous coremia of which had developed by 20th March. In places the mortality reached 90 per cent.

An unidentified basidiomycete occurred in epidemic form among bark beetles (*Ips typographus*) on spruces in Lower Austria in 1947–49, originating in the breeding galleries and destroying on an average 30 (in isolated cases up to 90) per cent. of the larvae and pupae and as many as 10 per cent. of the beetles. Although the fungus may be responsible for considerable damage to the insects locally—mostly where primary infection is rife in closed stands in deep hollows—its development depends on a combination of mild winters and wet summers, and its importance as a factor in biological control should consequently not be over-estimated. Staphylinids, especially *Placasa atrata*, *P. depressa*, and *Phloeopora testaceae*, were observed to feed on the mycelium in the breeding galleries.

The author has already reported (*Z. angew. Ent.*, 18, pp. 460–491, 1931) that the

mycelium of *Schizophyllum commune* may surround and permeate *I. typographus* in the breeding galleries.

Mischke (W.). **Einige durch Insekten übertragbare Viruskrankheiten an Topfpflanzen.** [Some insect-transmissible virus diseases of pot plants.]—*Pflanzenschutz*, 9, 7, pp. 96–97, 2 figs., 1957.

The viroses briefly described in this further contribution to the current series [36, p. 701] are mosaic of *Epiphyllum truncatum* [36, p. 323], transmitted by the greenhouse tubular coccid [*Orthezia insignis*]; leaf curl of *Pelargonium zonale*, of which the pelargonium aphid [*Macrosiphum pelargonii*] is probably the vector; *Primula* mosaic [33, p. 706], affecting *P. obconica*, *P. malacoides*, and *P. sinensis* and carried by the black bean aphid [*Aphis fabae*]; *Cattleya* mosaic and flower breaking [cf. 34, p. 153], transmitted by the peach aphid [*Myzus persicae*]; and tomato spotted wilt on begonia, slipper flower [*Calceolaria*], cineraria, gloxinia, *Primula*, amaryllis [*Hippeastrum*], and butterfly flower [*Schizanthus*], conveyed by tobacco thrips [*Thrips tabaci*].

Moreau (Mireille). **Le dépérissement des Œillets.** [Carnation wilt.]—(*Encycl. mycol.* 30), viii+308 pp., 19 pl., 6 diags., 20 graphs, Paris, Paul Lechevalier, 1957. Fr. 6,500.

This detailed and comprehensive study of carnation wilt in France [cf. 36, p. 415 *et passim*] is divided into nine chapters, dealing with fungal wilt diseases in general (pp. 5–18); carnations, the history of their cultivation, their diseases, and the conditions under which they are grown at Nice and in the vicinity of Paris (pp. 19–58); causes of carnation wilt diseases (pp. 59–105); a mycological study of the parasites causing carnation wilt (pp. 106–132); experimental infections and the sources of natural infection (pp. 133–167); conditions of infection and of parasitic development (pp. 168–190); the action of parasites upon the carnation (pp. 191–223); interference with parasitic action (by competition between fungi and antagonism between soil-inhabiting fungi) and the development of the fungal flora (pp. 224–248); and the control of carnation wilt diseases (pp. 249–293). The conclusions refer briefly to the technical methods used in the study; the systematy of the fungi concerned; their physiology and cytology; anatomy; genetics; evolution of the fungal flora; agronomy; and chemotherapy (pp. 294–301). There is a résumé on pp. 302–303, and a bibliography of 124 titles is appended.

Examination of affected carnations showed that nearly one hundred species of fungi could be found thereon, including saprophytes. Important parasites are *Phialophora* [*Verticillium*] *cinerescens*, *Fusarium oxysporum*, *F. roseum*, *Alternaria dianthi*, *Phytophthora cactorum*, *Rhizoctonia* [*Corticium*] *solani*, and *R. bataticola* [*Macrophomina phaseoli*]. A mycological study is provided on each of these, covering nomenclature, hosts, geographical distribution, morphology, and biology. The conditions required for infection to take place and for the fungus to grow within the plant are described for each parasite. The infection complex normally present in wilt diseases is regarded as a succession of fungi [loc. cit.], of which the various phases are defined: predisposing causes, parasitic stage, including primary and secondary parasites, and finally a saprophytic phase ending in equilibrium with the microflora of the surrounding soil. Control consists in improving the cultural conditions, the selection of resistant varieties, and fungicidal treatments. Remarkably good results were given by dichloro (*m.p.*) cresoxy-pentaethylene glycol (sapractyl A_5, 0·05 per cent. solution). In the vicinity of Nice the plants, even if apparently quite healthy, should be sprayed once every three weeks directly picking starts in October. If infection is present, two double-strength applications should be made with an interval of one week, after which normal spraying should be resumed. Cuttings should be taken only from plants sprayed a few days

before. Immediately after transplanting a preventive application should be made two or three times.

Hiratsuka (N.). **Three species of Chrysanthemum-rusts in Japan and its neighbouring districts.**—*Sydowia, Beih.* 1, pp. 34–44, 1957.

Information is presented on the taxonomy and distribution in Japan and adjacent territories of *Phakopsora artemisiae* [15, p. 609], *Puccinia chrysanthemi* [map 117], and *P. horiana* [36, p. 471], and on the results of inoculation experiments with these rusts on *Chrysanthemum* spp. at the Tokyo University of Education.

Out of 14 species *Phakopsora artemisiae* attacked *C. shiwogiku*, *C. pacificum* and its var. *radiatum*, *C. yoshinagathum*, *C. makinoi* (used as a control) and its var. *wakasaense*, *C. boreale*, and *C. morifolium* var. *sinense*.

Puccinia chrysanthemi was pathogenic only to *C. p.* var. *radiatum*, *C. makinoi*, *C. indicum*, and *C. m.* var. *sinense* out of the same species.

The very destructive *P. horiana* infected 9 of 15 species, viz., *C. nipponicum*, *C. arcticum* subsp. *mackawanum*, *C. shiwogiku*, *C. pacificum*, *C. makinoi*, *C. yoshinagathum*, *C. indicum*, *C. boreale*, and *C. m.* var. *sinense*.

Brierley (P.) & Smith (F. F.). **Symptoms of Chrysanthemum flower distortion, Dodder transmission of the virus, and heat cure of infected plants.**—*Phytopathology*, 47, 7, pp. 448–450, 1 fig., 1957.

Further studies of chrysanthemum flower-distortion virus [35, p. 610] at Beltsville, Maryland, showed it eventually to be lethal to all the chrysanthemum varieties tested. On graft inoculation (mechanical and fresh leaf methods gave negative results) the varieties Dauntless, Friendly Rival, Good News, Indianopolis White, and Monument showed flower deformation but no initial leaf symptoms. Dynamo, Golden Mistletoe, Ivory Seagull, Mary MacArthur, and Pandora were somewhat dwarfed, but not rosetted, and the flowers variously deformed.

By means of *Cuscuta campestris* the virus was transmitted to *Vinca rosea*, symptoms appearing after six months. A short, bushy plant resulted, with chlorosis of the leaves, black streaking of veins, and abnormal flower production.

Plants of White Wonder and Dynamo infected with the virus and placed in a greenhouse at 35° C. produced tip scions free from the virus after two and three months, respectively.

Symptoms produced on Blazing Gold by aster yellows virus differ somewhat in rate of development and in appearance from those due to the flower-distortion virus, and *Macrosteles fascifrons* transmitted the former virus from Igloo to China aster, but not the latter virus from White Wonder to China aster, also the symptoms of the two viruses on *Vinca rosea* differ widely; they would therefore appear not to be identical [cf. loc. cit.].

Binot (Noëlle). **Les parasites et ennemis des Dahlias.** [Diseases and pests of Dahlias.]—*Jardins de Fr.*, 4, pp. 153–159, 8 figs., 1957.

Mentioned *inter alia* are infections by *Corynebacterium fascians* [cf. 30, p. 162], *Agrobacterium tumefaciens* [25, p. 545], *Erwinia cytolytica* [*E. carotovora*], *Pseudomonas solanacearum*, *Verticillium albo-atrum* [30, p. 161], *Pythium debaryanum*, *Sclerotinia sclerotiorum* [30, p. 161], *Botrytis cinerea* [loc. cit.], dahlia mosaic virus [35, p. 482], [tomato] spotted wilt virus [loc. cit.], and cucumber mosaic virus [35, p. 812]. Applications of sprays based on captan, at 0·25 per cent., at 8-day intervals from the time of planting are recommended against *Entyloma dahliae* [36, p. 102].

Travis (R. V.). **Virus diseases of Iris.**—Abs. in *Phytopathology*, 47, 7, p. 454, 1957.

In addition to the known virus diseases of iris, namely (1) bulbous iris mosaic, (2) bearded iris mosaic, and (3) beardless iris mosaic [16, p. 254; cf. 30, pp. 23, 568]

two others, (4) mosaic of *Iris fulva*, and (5) iris ring spot are reported. All are transmissible mechanically; *Belamcanda chinensis* is susceptible to 2, 3, and 4. *Myzus persicae* transmits 1, 2, 3, and 4; *Macrosiphum solanifolii* [*M. euphorbiae*] 1, 3, and 4; and *Aphis fabae*, 3 and 4. Except iris ring spot, all are caused by relatively unstable viruses which are transmitted non-persistently. Only iris ring spot virus infects Bountiful bean [*Phaseolus vulgaris*], Samsun tobacco, *Chenopodium amaranticolor*, *Gomphrena globosa*, guar [*Cyamopsis psoraloides*], *Physalis angulatus*, and *Amaranthus retroflexus*. It is infectious after heating for 10 min. at 62° C., after dilution to 10^{-3}, and after 10 days at 20°. No evidence was obtained of cross protection between this virus and carnation ringspot, tomato ring spot, cucumber mosaic, tobacco etch, lucerne mosaic, or potato X viruses.

McWhorter (F. P.). **Association between Rhizoctonia and yellow coloration of Easter Lily bulbs.**—*Phytopathology*, 47, 7, pp. 447–448, 1 fig., 1957.

It is reported from Oregon State College, Corvallis, that treatment with PCNB of stem bulblets of Easter Lily [36, p. 700] planted in soil known to contain *Rhizoctonia* [*Corticium*] *solani* resulted in production of yearling bulbs free from the yellow pigmentation normally found in their scales. On the yellowed scales of other bulbs examined the extent of yellowing was found to be correlated with the degree to which *C. solani* was present. The chemical nature of the pigment and whether it protects against fungus invasion or forms as a result of it is being investigated.

Anzalone (L.) & Plakidas (A. G.). **Cercospora leafspot of Photinia serrulata.**—*Mycologia*, 49, 3, pp. 412–416, 1 fig., 1957.

An account is given of a leaf spot of *Photinia serrulata* common in Louisiana and observed also in Georgia. The lesions appear as indefinite chlorotic spots 1 to 2 mm. in diameter on the upper and lower surfaces of the leaves. They later turn purple, increase to 2 to 25 mm. in diameter, and finally become dark brown. Lesions on the new growth usually appear in June and may cause almost total defoliation by the end of October. The disease was ascertained to be due to a species of *Cercospora*, named *C. photiniae-serrulatae* n.sp., which is characterized by straight to slightly geniculate conidiophores 10·4–42·9 by 2·6–3·9 μ, and hyaline, obclavate, straight to slightly curved conidia, 1- to 10-indistinctly septate, 29·9–99·3 by 1·9–2·8 μ.

Montant (C.). **Modifications du métabolisme des acides aminés de Rhododendron ferrugineum L. provoquées par Exobasidium rhododendri.** [Modifications in the metabolism of the amino acids of *Rhododendron ferrugineum* L. induced by *Exobasidium rhododendri*.]—*C. R. Soc. Biol., Paris*, 151, 1, pp. 182–184, 2 diags., 1957.

The chromatographic analysis at the Faculty of Sciences, Toulouse, France, of specimens of *Rhododendron ferrugineum* leaves parasitized by *Exobasidium rhododendri* [? *E. azaleae* or *E. vaccinii*] in the eastern Pyrenees revealed, *inter alia*, an increase of peptides, aspartic and glutamic acids, and glycine and a reduction of asparagine, glutamine, and proline as compared with healthy foliage, together with the appearance of α-amino-butyric and α-amino-adipic acids, which do not occur in uninfected material.

McClellan (W. D.), Taylor (E. A.), & Smith (F. F.). **Relation of fungicide and miticide treatments to winter injury and spring blackspot development on Roses.**—*Phytopathology*, 47, 6, pp. 357–360, 1957.

At Beltsville, Maryland, 29 fungicide-miticide dust combinations were tested during 1954–5 on five varieties of roses against black spot (*Diplocarpon rosae*) and spider mites (*Tetranychus telarius*) [cf. 36, p. 648]. The fungicides were 3·4 per cent.

copper, alone and with 25 per cent. sulphur; 7·6 per cent. ferbam with 25 per cent. sulphur; 1 per cent. karathane (for control of powdery mildew [*Sphaerotheca pannosa*]); 5 per cent. captan; and 6·5 per cent. zineb.

Good black spot control in one year, which was best achieved with the sulphur mixtures and zineb, resulted in earlier and better flowering and less black spot the following year, and reduction of black spot reduced winter killing of wood. Golden Masterpiece was especially sensitive to black spot, Red Radiance least so; Chief Seattle was also susceptible to black spot, and Peace tolerant; Christopher Stone was susceptible to mildew.

EDWARD (J. C.). **Leaf and inflorescence blight of Tagetes erecta (Marigold) caused by Alternaria zinniae Pape.**—*Sci. & Cult.*, 22, 12, pp. 683–684, 2 figs., 1957.

At the Biology Department, Allahabad Agricultural Institute, India, *Alternaria zinniae* [cf. 25, p. 581] was identified as the cause of a leaf and inflorescence blight of *Tagetes erecta* in the Institute's garden. This appears to be a new host record. Effective control was obtained by spraying with dithane before the appearance of the disease (beginning of September) or during the early stages of infection (late September to early October).

KANDASWAMY (M.) & SUNDARAM (N. V.). **Notes on two fungi from South India.**—*Indian Phytopath.*, 9, 1, pp. 76–77, 1 fig., 1956.

The discovery in India of *Oidiopsis* [*Leveillula*] *taurica* on living leaves of *Verbena bonariensis* constitutes a new host record for this fungus.

BREMER (H.). **Zur Artfrage bei den an Vinca schmarotzenden Puccinien.** [On the species problem in the Pucciniae parasitic on *Vinca*.]—*Sydowia, Beih.* 1, pp. 124–127, 1 pl., 1957.

The problem of the identity of *Puccinia vincae* on *Vinca major*, *P. anatolica* on *V. herbacea*, and *P. cribrata* on *V. minor* [25, p. 503] is re-examined in the light of studies on parasitized material of the first-named host collected in Turkey in 1949. No justification can be found for Gassner's erection of *P. anatolica* as a new species on the basis of minor deviations in spore dimensions from *P. vincae*, which would merely entitle it to varietal or subspecific rank. The older name of *P. vincae* should therefore be retained. *P. cribrata*, on the other hand, cannot be referred to *P. vincae* on account of its appreciably longer and more falcate teleutospores and must continue to rank as a distinct species pending the discovery of transitional forms.

NAUMOVA (Mme N. A.). Особенности развития склеротинии на Подсолнечнике в условиях Воронежской области. [Peculiarities in the development of *Sclerotinia* on Sunflower under the conditions of the Voronezh region.]—*Trud. vsesoyuz. Inst. Zashch. Rast.* 5, pp. 62–82, 4 figs., 1954. [Received 1957.]

The annual recurrence of *Sclerotinia* [*sclerotiorum*] in sunflower fields of the Voronezh region, U.S.S.R. [11, p. 652], is due to heavy soil infestation. Control measures include periodic soil sterilization coinciding with the appearance of the disease; crop rotation and sowing away from the previous year's infested sunflower plots, which should be disinfected; destruction of weeds; seed disinfection; and removal of diseased shoots and plant debris. The variety Chernyanka 11-a is less susceptible than Chernyanka 35; Voronezh 647 also appears to be promising.

STEPANOVA (Mme M. Y.). Обогрев семян Подсолнечника как метод борьбы со склеротинией. [Heating Sunflower seeds as a method of controlling *Sclerotinia*.]—*Trud. vsesoyuz. Inst. Zashch. Rast.* 5, pp. 115–119, 1954. [Received 1957.]

The following treatment is recommended for the control of *Sclerotinia* [*sclerotiorum*] on sunflower in the U.S.S.R. [see preceding abstract]. Carefully selected,

healthy seed is exposed to the sun in open barns and prior to a prolonged storage is kept for seven to ten days at 40° C. in special dryers or in a warm room. The storage place should be dry and the seed systematically ventilated.

Johnson (H. W.). **Lamont, a new variety of Rescuegrass resistant to head smut.**—*Phytopathology*, 47, 7, pp. 409–412, 1 fig., 1957.

Trials by the United States Department of Agriculture and the Mississippi Agricultural Experiment Station, Stoneville, have shown a selection of rescuegrass (*Bromus cathartıcus*) introduced from Uruguay (P.I. No. 193144) and known as Lamont to be resistant to strains of head smut (*Ustilago bullata*) [cf. 36, p. 324] from four States and only moderately susceptible to an apparently different race of the fungus from Louisiana. It compared favourably in forage production with the Commercial, Texas 46, and Chapel Hill varieties, all of which were susceptible to the smut, and its resistance gave Lamont marked superiority in yield of seed.

Stewart (R. B.). **The morphology of the sclerotium of Claviceps paspali.**—*Phytopathology*, 47, 7, pp. 444–445, 2 figs., 1957.

Study of the sclerotia of *Claviceps paspali* on Dallis grass [*Paspalum dilatatum*: 33, p. 607] in South Central Texas, reported from the Agricultural and Mechanical College of Texas, College Station, showed the mature sclerotia to have three distinct layers. A surface layer, composed of dead cells, may be 240 μ thick and is roughened and cracked. Underlying this is a transitional layer some 15 μ thick, which stains differently from the two other layers with modified Conant's stain. The interior germ layer forms 90 per cent. of the sclerotium, and the stipe is initiated within it when fruiting bodies form.

Schmiedeknecht (M.). **Betrachtungen zur Biologie einiger wichtiger Blattfleckenkrankheiten der Luzerne.** [Observations on the biology of some important leaf spot diseases of Lucerne.]—*NachrBl. dtsch. PflSchDienst, Berl.*, 11, 4, pp. 66–71, 2 figs., 1957.

The author briefly reviews present knowledge on two leaf spots of lucerne, caused by *Pseudopeziza medicaginis* [25, p. 455] and *Pleospora herbarum* [cf. 13, p. 390], both of which cause important losses in Germany. He concludes that for both breeding for resistance constitutes the most promising approach to control [cf. 33, p. 431]. A table summarizes the distinctions between leaf spots caused by these pathogens and by *Pyrenopeziza medicaginis* [map 141].

Mende (V. N.). Фузариозные заболевания Клевера и агротехнические мероприятия в борьбе с ними. [*Fusarium* diseases of Clover and agrotechnical measures for their control.]—*Trud. vsesoyuz. Inst. Zashch. Rast.* 5, pp. 83–105, 4 figs., 1954. [Received 1957.]

A survey during 1947–50 showed that the failure of clover crops in the Leningrad and neighbouring districts of the U.S.S.R. was due to *Fusarium* spp. [35, p. 612], *F. avenaceum* var. *herbarum*, *F. oxysporum*, and *F. bulbigenum* being the most active. Infection often reached 44·6 to 51·5 per cent. in the spring. Varieties having a prolonged period of vernalization were more resistant than the mid-winter and spring types with a short vernalization period. Sivoritsky 416, Volosovsky, Efimovsky, Kingiseppsky, and Cherepovetsky were among the more resistant.

Infection was decreased by liming the soil, applying organic and mineral fertilizers, and by careful cultivation of the plantings in the first three years of growth.

Kreitlow (K. W.), Hunt (O. J.), & Wilkins (H. L.). **The effect of virus infection on yield and chemical composition of Ladino Clover.**—*Phytopathology*, 47, 7, pp. 390–394, 1 fig., 1957.

The effect of virus infection on Ladino clover [cf. 33, p. 871 was investigated by

the United States Department of Agriculture at Beltsville, Maryland, by comparing the growth of healthy clonal lines of this clover in the greenhouse and in the field with the same inoculated with a mixture of bean yellow mosaic virus [cf. 35, p. 682] and lucerne mosaic virus [29, p. 29]. The results obtained were similar in both series, showing that virus infection reduced yielding ability from 23 to 55 per cent. [cf. 34, p. 725], even in cases where visible symptoms were scarcely noticeable. Infected plants contained a lower percentage of crude fibre, but a higher nitrogen-free extract. Protein percentage was more dependent on environment and degree of maturity at harvest than on virus infection.

Boone (D. M.) & Keitt (G. W.). **Venturia inaequalis (Cke.) Wint. XII. Genes controlling pathogenicity of wild-type lines.**—*Phytopathology*, 47, 7, pp. 403–409, 9 figs., 1957.

This further contribution from the University of Wisconsin, Madison [cf. 36, p. 474], sets out in detail investigations of the genetics of the pathogenicity of *Venturia inaequalis* on apples which have already been noticed in part [32, p. 386]. The present study involved 15 apple varieties and 10 monosporic lines of *V. inaequalis* [cf. 35, p. 829]. The inheritance and effects of the seven known gene pairs involved are reported. With the exception of gene pair four, found approximately 13 cross-over units from its centromere, the pairs appear to be 33 units or more from their respective centromeres. Where gene pairs at different loci control pathogenicity to one variety, the alleles conditioning flecks proved epistatic to those conditioning lesions.

Bulit (J.). **Contribution a l'étude biologique du Nectria galligena Bres., agent du chancre du Pommier.** [A contribution to the biological study of *Nectria galligena* Bres., the cause of Apple canker.]—*Ann. Inst. Rech. agron.*, Sér. C (*Ann. Épiphyt.*), 8, 1, pp. 67–89, 9 graphs, 1957.

Probably owing to the very wet autumn of 1954, apple canker (*Nectria galligena*) [27, p. 425] was very severe in France in the spring of 1955. The Canadian varieties Reinette grise and Reinette blanche were heavily attacked in the summers of 1955–6, 30 per cent. of the shoots being infected on occasion, and sometimes nine fruiting cankers occurring on shoots only 60 cm. long. Reine des Reinette, Richard Red, Reinette du Mans, and the local varieties Faro and Barré all proved susceptible, and King David somewhat so, but Golden Delicious was less, and Boskoop, Starking Delicious, and La Nationale were resistant.

A study of the production and release of the ascospores and macroconidia was made on trees of four infected varieties (Calville blanc, Reinette grise de Canada, Reinette blanche de Canada, and Belle Fille rose) at Versailles in 1954–5. This demonstrated the extreme susceptibility to infection of the one-year-old wood. Cankers appear at the leaf scars and kill the young shoots, and on pruning cuts are a permanent source of inoculum as a canker sporulates continuously throughout the year. Ascospores and macroconidia form profusely during summer, while in winter and early spring the production of macroconidia usually declines, ascospore production often increasing. There appears to be antagonism between the production of the two types of spore. Release of the ascospores and conidia is closely related to rainfall, but is proportionately greater in summer and autumn than in winter and spring.

For a single autumn spray treatment to be effective it must be timed in accordance with the degree of rainfall. At Versailles, leaf fall generally occurs after 10th November, at which time rain reduces the temperature sufficiently to retard spore germination markedly and prevent contamination for about one day after the beginning of the rain, which gives time (provided the showers are not too prolonged or too frequent) for spray application. In autumn, infection depends on the amount

of inoculum present. One application of spray would be unavailing in a severely diseased orchard; in such the greatest possible number of cankers must be destroyed.

Ryall (A. L.) & Uota (M.). **Further studies with sealed polyethylene liners for Pajaro Valley Yellow Newtown Apples.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 84–90, 2 graphs, 1957.

At the Horticultural Field Station, Fresno, California [35, p. 106], scald and [unspecified] decay were considerably reduced in Yellow Newtown apples stored at 40° or (less effectively) 45° F. in sealed polyethylene box liners [see below]. Internal browning was controlled by storage at either temperature, with or without the liners.

Hardenburg (R. E.) & Siegelman (H. W.). **Effects of polyethylene box liners on scald, firmness, weight loss, and decay of stored eastern Apples.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 75–83, 1957.

In studies at Beltsville, Maryland, Rome Beauty, Arkansas, Grimes Golden, Jonathan, and Golden Delicious apples in boxes lined with sealed 150-gauge polyethylene [see above and below] stored at 31° F. ripened more slowly and had less scald than apples stored in non-sealed film liners. The best protection against scald was given by a combination of individual oiled wraps and sealed box liners. Differences in experimental results are attributed to a lack of standardization of permeability of the polyethylene sheets.

Smock (R. M.). **A comparison of treatments for control of the Apple scald disease.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 91–100, 8 graphs, 1957.

At Cornell University, Ithaca, New York, promising control of storage scald of Cortland and R[hode] I[sland] Greening apples [36, p. 105] was given by dips in 500 to 2,000 p.p.m. diphenylamine or higher concentrations of santoquin (6-ethoxy-1, 2-dihydro-2, 2, 4-trimethylquinoline). Scald was sometimes reduced by storage in sealed polyethylene box liners [see above] but injury from carbon dioxide was noted in some samples of Cortland and from low oxygen concentration in McIntosh.

Wiederspahn (F. E.). **Controlled manganese deficiency of Apple.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 17–20, 1 fig., 1957.

At the Department of Horticulture, Rutgers University, New Brunswick, New Jersey, Rome Beauty apple seedlings grown in solution cultures with 0·001 p.p.m. manganese or less developed deficiency symptoms [34, p. 602] which included interveinal necrotic spotting and light green coloration of the terminal leaves and a reduction in leaf area and shoot diameter. The weight of the deficient plants and the quantity of roots produced were less than normal. With a decrease in the total manganese in the leaves the soluble iron concentration increased but insoluble and total iron were not affected.

Baskett (W. J.). **Trace element deficiencies in fruit trees and Vines.**—*J. Dep. Agric. S. Aust.*, 60, 11, pp. 475–481, 499, 9 figs., 1957.

This is a practical paper describing and prescribing treatment for zinc, manganese, and copper deficiency in citrus; zinc deficiency in the vine; and zinc, iron, and manganese deficiency in pome and stone fruits.

Higdon (R. J.). **Pear tree chlorosis with special reference to its correction with chelated metals.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 101–109, 1 fig., 1957.

In trials in the Rogue River Valley, southern Oregon, better correction of iron deficiency chlorosis in Anjou pear trees [cf. 36, p. 425] was obtained with combined

sprays of chelated manganese and iron (as the salts of ethylene-diamine tetra-acetic acid) than when iron chelate was used alone. Limb injections or sprays of EDTA or its sodium salt also caused greening of chlorotic foliage. EDTA and its iron and sodium salts were highly toxic to pear leaves and fruit, Anjou and Bosc being less susceptible to injury than Comice and Bartlett. Applications of chelates to the soil surface were ineffective, but injections of 1 lb. chelated iron per tree into the soil gave a response. The iron salt of DTPA (diethylenetriamine penta-acetic acid) applied as sprays of 2½ to 3 lb. in 100 to 300 gals. per acre was almost non-toxic. Two applications in the first half of the growing season were sufficient except against severe chlorosis, when a third was necessary.

Schmidle (A.). **Phomopsis mali Roberts als Erreger von Rindenschäden an Pflaumenbäumen.** [*Phomopsis mali* Roberts as agent of cortical injury to Plum trees.]—*Phytopath. Z.*, **29**, 3, pp. 327–338, 7 figs., 1957.

Diaporthe perniciosa is reported from the Horticultural Institute, Heidelberg, Germany, to have recently caused severe cortical necrosis of 15-year-old plum trees [**36**, p. 250], especially of the Ontario, Gerstetter, Kirkes, Gute von Bry, and Wangenheim varieties; on Zimmers Frühzwetsche and Nancy Mirabelle the symptoms were milder and Bühler Frühzwetsche was scarcely affected. The shield-shaped necroses, which originate at the onset of growth as brown discolorations, are nearly always situated round leaf scars and buds and also at the base of short shoots. During the summer the cortex ruptures, often exuding gum and exposing the brown to brownish-black wood; the discoloration, which also involves parts of the medulla, extends for a few millimetres below the healthy green bark. Since the cambium underlying the necroses is dead no further increment of wood can occur, and the resultant unilateral development imparts a squashed and flattened appearance to the branches. In the light of present observations the necroses caused by *D. perniciosa* appear to be consistently 'annual'; that is to say, unless the branches are girdled callus formation begins from the tissues formed at the periphery of the wounds and initiates the healing process. The disease, therefore, is a typical 'Rindenbrand' as distinct from a 'Baumkrebs', which has a perennial connotation [**35**, p. 561].

The principal morphological characters of *D. perniciosa* are briefly described and its taxonomy is discussed. Inoculation experiments were performed on branches of 14-year-old Ontario trees with spores and mycelium of four isolates of the fungus in August and October, 1955, and April, 1956. The results of the August and April tests were negative, whereas those carried out at the time of leaf fall in October were uniformly positive. In general, however, the cortical necroses were of limited extent and seldom girdled the branch. Destruction of the cortex is restricted to the dormant period, which induces in the host the requisite predisposition to attack by the wound parasite.

Blodgett (E. C.). **Prune crinkle leaf.**—*Phytopathology*, **47**, 7, pp. 418–420, 1 fig., 1957.

From the Irrigation Experiment Station, Prosser, Washington, the writer describes a condition of Italian prune [plum] designated as prune crinkle leaf, with symptoms similar to sweet cherry crinkle leaf [**24**, p. 324; **32**, p. 681]. The condition probably appears wherever the prune is grown in the United States, and has been observed on a number of varieties (which are named). The symptoms are described in detail, and include leaf deformation, chlorosis, and poor bearing; they may occur on one part of a tree only. Prune crinkle leaf often accompanies other similar disorders, confusing its identification. The condition is not transmissible by budding and is considered to be of a genetic nature, and similar to sparse leaf of prunes [loc. cit.], and prune leaf spot [**19**, p. 480; **25**, p. 384].

Carter (M. V.). **Vines aid spread of Apricot gummosis.**—*J. Dep. Agric. S. Aust.*, 60, 11, pp. 482–483, 2 figs., 1957.

In Jan. 1957, in the Modbury district, some dead vine branches were found bearing stromata closely resembling those of *Eutypa armeniacae* on apricot. Isolation of the fungus and inoculation into apricot confirmed its identity, and in a subsequent search it was found to be widely distributed on dead wood of many vine varieties in districts (including the Barossa Valley, Watervale, the Adelaide metropolitan area, and Coonawarra) where the average rainfall is above 13 in. Infected vine wood apparently becomes infectious at about the same age as infected apricot wood [35, p. 376]. Work is in progress at the Waite Institute to determine whether *E. armeniacae* is an active parasite of the vine or merely a secondary invader of dead wood. The destruction of dead wood, except for canes removed at annual pruning, is, however, essential.

Smith (M. A.) & Ramsey (G. B.). **Fruit decay and twig cankers on Peach.**—*Phytopathology*, 47, 7, pp. 445–446, 1 fig., 1957.

During storage tests of South Carolina Elberta peaches by the United States Department of Agriculture at Chicago, in 1953, a fruit rot, starting as a brown surface discoloration, which later developed a white surface mould, was found to be due to *Phomopsis* sp. On inoculation the fungus also caused cankers on peach twigs and it was accordingly identified as the organism causing constriction disease of peach, referred to as *Phoma persicae* (*Diaporthe eres*) [*D. perniciosa*: 30, p. 522] but which this study suggests should be transferred to *Phomopsis*.

Daines (R. H.) & Gray (R.). **Streptomycin foliage sprays and control of bacterial spot of Peach.**—*Phytopathology*, 47, 7, p. 448, 1957.

Further trials during 1956 against *Xanthomonas pruni* on peach [36, p. 252], carried out by Rutgers University, New Brunswick, in co-operation with the Merck, Sharp, and Dohme Research Laboratories, Rahway, both in New Jersey, showed that the addition of streptomycin (150 p.p.m.) to captan, though too expensive for commercial practice, gave much better control than captan alone, or than sulphur, and that the addition of glycerol resulted in better absorption of the streptomycin [35, p. 700] than pyrox (pyrophillite). Streptomycin formulations reduced fruit infection to around 6 to 9 per cent. compared to some 13 to 23 per cent. for captan and sulphur, and 12·7 to 14·8 per cent. for zinc formulations.

Gualaccini (F.). **A virus disease of Sweet Cherry in Italy.**—*F.A.O. Pl. Prot. Bull.*, 5, 9, pp. 142–144, 4 figs., 1957.

In June, 1956, the Durona nera and Durona della Marca varieties of sweet cherry growing in the Province of Modena, Italy, were found to be affected by a new disease causing reduced growth of buds, withering of branches, and the production of small or tufted leaves. Chlorotic spots, curling, shot holes, and laceration affected many leaves; occasionally the veins in the lower half were red or there was necrosis of the tip [36, p. 653].

The disease was transmitted by budding to the Shirofugen and Kwanzan varieties of the oriental flowering cherry (*Prunus serrulata*), gummosis and bark canker developing near the grafted buds. Both varieties are highly sensitive, and may be used as indicators. On Burbank plum grafted with diseased sweet cherry, branches with deformed leaves were produced near the point of bud insertion. Some leaves were narrow or almost filiform, while others were affected by a downward rolling of the edges or tip due to the limited growth of the midribs. Many leaves displayed a chlorosis of the veins and adjacent areas, the reticular pattern resembling that reported on Shiro plum in Italy [35, p. 618]; the symptoms are also like those of the rasp leaf virus on sweet cherry in Denmark [cf. 36, p. 472].

The disease appears to be caused by a mixture of viruses or virus strains and resembles the [peach] ring spot virus disease of stone fruits occurring in North America [cf. 36, p. 599].

Mallinjoud (H.-M.). **Considérations sur l'état sanitaire des plantations de framboisiers en Haute-Savoie.** [Considerations on the health status of Raspberry plantations in Haute-Savoie.]—*Rev. hort., Paris*, 129, 2218, pp. 1676–1679, 4 figs., 1957.

Anthracnose (*Elsinoe veneta*) is the most important disease, and is often associated with spur blight (*Didymella applanata*). Grey mould (*Botrytis cinerea*) causes severe fruit losses following heavy rain or insect attack. Crown galls [*Agrobacterium tumefaciens*] are quite common, but rarely cause much damage. Virus diseases are not yet important, but some 'leaf mosaic' and 'interveinal yellows' are met with.

Müller (H. W. K.). **Zum Auftreten und zur Bekämpfung des Erdbeermehltaues unter Berücksichtigung der Erdbeergraufäule.** [Concerning the occurrence and control of Strawberry mildew, with regard also to Strawberry grey mould.]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, 9, 6, pp. 85–88, 1957.

Intensive strawberry cultivation around Hamburg, particularly in the Vierländer district, has led to a build-up of mildew (*Sphaerotheca humuli*) and of grey mould (*Botrytis cinerea*). Following fungicide trials at the Institute for Applied Botany, Hamburg, to discover an effective treatment for the two diseases, it is recommended that a combined preparation of TMTD [thiram] and wettable sulphur be applied at 0·75 per cent. just before the main flowering, and again at the end of flowering and one to two weeks before harvest. After harvest two further applications (the second at 0·5 per cent.) are required to assure strong leaf growth and normal development of runners and young plants. All other treatments tried, including thiram alone, karathane, and PÄTD alone and with wettable sulphur, were inferior.

Nelson (P. E.). **Pathogenicity of Idriella lunata on Strawberry.**—*Phytopathology*, 47, 7, pp. 438–443, 2 figs., 1957.

Studies at the University of California, Berkeley, showed the fungus *Idriella lunata* [36, p. 199] to be one of the pathogens responsible for the deterioration of strawberry roots. Characteristic masses of chlamydospores form in the outer cortex of the root, in the vessels, and in lesions. Infection takes place initially at the root tips, and as it proceeds rootlet degeneration is followed by the formation of black sunken lesions on the adventitious and branch roots. The fungus is extremely susceptible to temperature, optimum growth occurring at 19° to 22° C., and growth ceasing below 7° and above 34°. The organism caused no damage to strawberry leaves in an experiment in which *Mycosphaerella fragariae* did so, nor did it cause pre- or post-emergence damping-off of strawberry seedlings in the greenhouse.

In the field *I. lunata* has only been isolated from diseased strawberry roots. Greenhouse inoculation experiments with a number of plants showed that it could grow in or on the roots of tomato, [chilli] pepper (*Capsicum frutescens*), carrot, lettuce, and *Potentilla nepalensis* without damaging them, and that it was able to parasitize the roots of Honeydew and Baby Persian melon to some extent. *I. lunata* would seem to be an important primary parasite of strawberry roots in parts of California, and to facilitate the subsequent invasion of the roots by other fungi.

Johnston (A.). **Bacterial heart rot of the Pineapple.**—*Malay. agric. J.*, 40, 1, pp. 2–8, 6 pl., 1957.

Pineapple heart rot, first definitely recorded from Johore in 1936 [16, p. 657; 18,

p. 503; 33, p. 523], though a bacterial bud rot of pineapple had been noted in 1927 [7, p. 704], is now present in all the chief pineapple-growing areas of the Federation of Malaya. On peat soils damage is slight, but on some quartzite soils 10 per cent. losses have been recorded. Infection usually occurs in plants three to eight months old. The basal parts of the youngest leaves have a dull, water-soaked appearance, turning dark green, and then greenish-yellow as infection spreads rapidly upwards. If spread becomes arrested, the infected area is bounded by one or more dark purple or brown bands, above which there may be a broader, paler area separated from the healthy part of the leaf by an indefinite, yellowish zone. The basal parts of infected leaves become so soft-rotted that the central rosette can easily be detached; further up the internal tissues disintegrate completely but the epidermis remains intact. Similar symptoms occur on older plants, and if bearing, the rot extends into the stem of the fruit. Infection, which takes place in the heart of the plant and spreads outwards, also destroys the growing-point. Progress is rapid, and early stages are seldom found in the field. In severe cases, death ensues, but affected plants usually produce new shoots from lateral buds, which generally remain healthy.

Pathogenicity tests with bacteria from infected material reproduced the disease; nine pathogenic isolates from different areas were ascertained to be morphologically and physiologically identical. The pathogen was a Gram-negative, non-sporing, highly motile rod measuring (in 48-hour cultures on beef-extract-peptone-agar) 1·2–3·5 by 0·5–0·8 (mean, 2·2 by 0·6) μ, and was identified as a strain of *Erwinia carotovora*.

Spraying with Bordeaux mixture or streptomycin sulphate failed to give control. Growers are advised to dip their slips in Bordeaux mixture before planting; to prevent the entry of soil into the heart of the plant; to destroy severely affected plants; and to remove the rotted leaves from slightly affected plants and spray the heart with a copper fungicide.

CASARINI (B.). **Il saggio 'in vivo' degli anticrittogamici.** [The '*in vivo*' assay of fungicides.]—*Phytopath. Z.*, 29, 3, pp. 277–286, 3 figs., 1957. [German summary.]

The following method was devised at the Institute of Plant Pathology, Bologna [36, p. 537], to obviate the drawbacks inherent in existing procedures for the laboratory assay of fungicides. A given quantity of spores of a pathogen (*Plasmopara viticola* in the author's experiments) is conveyed in an aqueous solution of the fungicide to be tested to the leaves of the appropriate host (vine). This technique not only ensures a constant relation between the quantity of the fungicide, the number of spores, and the diluting water volume but also guarantees a uniform contact between the conidia and the fungicide. At any rate during the period elapsing between treatment and infection the fungicide is subjected to the influence of conditions identical with those obtaining in nature.

Fungicides of known activity against *P. viticola* were used as controls in suspensions of various concentrations, e.g., 1 in 100,000, 1 in 200,000, and 1 in 400,000 for copper-containing compounds, represented by copper oxychloride, and 1 in 30,000, 1 in 60,000, and 1 in 100,000 for non-cupric preparations, e.g., zinc ethylene bisdithiocarbamate [zineb]. The fungicides to be tested were assayed in dilutions of 1 in 10,000, 1 in 30,000, and 1 in 90,000. Equal quantities of these suspensions were distributed in test tubes and an equal amount of a conidial suspension (50,000 per ml.) added to each. The suspensions were applied with a glass atomizer both to detached and growing vine leaves held in a saturated atmosphere at 20° to 23° C. The leaves were dried off after 24 hours and comparative readings of the numbers of lesions taken two days after the appearance of the first conidia.

Duddington (C. L.). **The friendly fungi.**—188 pp., 24 pl., 7 figs., London, Faber and Faber, 1957. 21*s*.

This is a popular account of the life history and structure of the predacious fungi attacking nematodes [33, p. 352; 36, p. 502]. The possibilities of biological control of plant-pathogenic eelworms by means of these nematode-catching fungi are outlined. Among the examples given is the control of the pineapple root-knot nematode in Hawaii [18, p. 737] and reference is made to French investigations [19, p. 149]. In small-scale field trials in England in 1954 and 1955 encouraging results were obtained in the control of the potato root eelworm by the addition of manure plus cultures of *Dactylaria thaumasia* but not by the fungus alone.

In two appendices notes are given on the collection, cultivation, and examination of predacious fungi and their manipulation by amateurs.

Walker (J. C.). **Plant pathology.**—xi+707 pp., 194 figs., New York, Toronto, London, McGraw-Hill Book Company, Inc., 1957. $10.00; 75*s*.

In the second edition of this comprehensive textbook, which is designed to outline the principles underlying the science of plant pathology, an introductory chapter is followed by others dealing with the history of plant pathology, non-parasitic diseases, bacterial diseases, diseases caused by Plasmodiophorales, phycomycetes, fungi imperfecti, ascomycetes, basidiomycetes, parasitic phanerogams, nematodes, and viruses. Important representative diseases are selected and their incidence, etiology, and control described. Further chapters discuss the relation of environment to disease development, host-parasite interactions, and control by exclusion and eradication, protection, and host resistance. Each chapter concludes with a list of references.

Kuhnholtz-Lordat (G.). **Les problèmes généraux de phytopathologie dans le cadre de la parasitologie générale.** [The general problems of phytopathology within the framework of general parasitology.]—*Rev. Mycol., Paris*, 22, 1, pp. 3–25, 1957.

In two lectures delivered before the Faculty of Medicine of Montpellier University, the author put forward his views on the general principles of parasitology as they relate to plants, with emphasis in the second lecture on physiological aspects of parasitism.

Müller (H.). **Ein Jahrzehnt Pflanzenschutzforschung und Pflanzenschutzdienst in Deutschland — Rückblick und Ausblick 1947–57.** [A decade of plant protection research and plant protection service in Germany—retrospect and prospect 1947 to 1957.]—*Z. PflKrankh.*, 64, 7–10, pp. 385–391, 1957. [English summary.]

In this paper, presented at the 4th International Plant Protection Conference, held from 8 to 15 September at Hamburg, an outline is presented of the reorganization during the last decade and current activities of scientific research in plant pathology and the Plant Protection Service in Germany. The work is carried on at the two main centres, Berlin-Dahlem and Brunswick, and nine branches. Among the functions described in some detail are the reporting and warning service, official supervision of plant-protective preparations and apparatus, and the study of virus diseases, while mention is briefly made of various other problems under investigation.

Müller (K. O.). **Theoretische Betrachtungen zur Epidemiologie anemochorischer Pflanzenkrankheiten.** [Theoretical considerations on the epidemiology of wind-borne plant diseases.]—*Z. PflKrankh.*, 64, 7–10, pp. 402–407, 1 graph, 1957. [English summary.]

This is an amplified version of the author's contribution to the Plant Diseases

Conference held at Hawkesbury Agricultural College, New South Wales, in 1955 [35, p. 353].

Rademacher (B.). **Die Bedeutung allelopathischer Erscheinungen in der Pflanzenpathologie.** [The significance of allelopathic phenomena in plant pathology.] —*Z. PflKrankh.*, 64, 7–10, pp. 427–439, 1 fig., 1957. [English summary.]

Over 100 contributions to the literature were consulted in this survey of allelopathy (defined as the influence exerted by one plant on another by metabolic products, either emerging from the living plant or released by its dead residues) in relation to non-parasitic disorders.

Bremer (H.). **Neuere Ergebnisse der deutschen Pflanzenschutzforschung im Gemüsebau.** [Recent results of German plant protection research in vegetable growing.]—*Z. PflKrankh.*, 64, 7–10, pp. 631–637, 1957. [English summary.]

This is a progress report of developments or discoveries (since about 1950) in the study of plant protection against diseases and pests in Germany. Most of the work on plant pathology has already been noticed in this *Review*.

Fischer (W.). **Radioisotope in Phytopathologie und Pflanzenschutz.** [Radioisotopes in phytopathology and plant protection.]—*Nachrbl. dtsch. PflSchDienst (Braunschweig), Stuttgart*, 9, 6, pp. 88–94, 1957. [64 refs.]

This general paper on progress in the use of ionizing radiation and radio-isotopes in biological work includes notes on the use of tracer elements to label insects, plant nutrients, and fungicides [cf. 35, p. 471; 36, p. 712].

Horsfall (J. G.) & Dimond (A. E.). **Interactions of tissue sugar, growth substances, and disease susceptibility.**—*Z. PflKrankh.*, 64, 7–10, pp. 415–421, 1957.

Many of the 41 contributions to the subject indicated in the title have been noticed from time to time in this *Review*. Mention may be made of the work of Gauch and Dugger (*Bull. Md agric. Exp. Sta.* A-80, 43 pp., 1954) on the role of boron in the translocation of sugars. A high sugar content in the foliage points to boron deficiency.

Butler (E. E.). **Rhizoctonia solani as a parasite of fungi.**—*Mycologia*, 49, 3, pp. 354–373, 3 figs., 1957.

More detailed studies are presented from the Minnesota Agricultural Experiment Station, St. Paul, of the behaviour of *Rhizoctonia* [*Corticium*] *solani* as a parasite of fungi [30, p. 422]. Two kinds of host resistance were noted, lysis of the parasitic hyphae, and the walling-off of infection filaments. In the relationship between *C. solani* (isolate R-5) and *Rhizopus nigricans* [*R. stolonifer*] some parasitic hyphae break down shortly after entering the host. In this case, the invading hyphae may be actively eliminated by the host protoplasm, but in all other relationships studied lysis seemed to be delayed until infection had reached a maximum. Infection hyphae are often walled off by a protective sheath; in *Mucor recurvus* this sheath and the walls of the young sporangiophores stain a light blue to purple colour with zinc-chloriodide. In the coiling type of host-parasite relationship [loc. cit.], the protoplasm of the encircled hyphae either coagulates into oil-like globules or becomes progressively less dense and disappears. Except for *Ambylosporium botrytis*, only members of the Mucorales and Peronosporales were parasitized.

C. solani does not, apparently, diffuse an antibiotic or other harmful substance. From experiments with cotton fibres it is inferred that penetration of the host occurs as a result of mechanical pressure. The internal parasitic hyphae did not visibly hydrolyse or decompose the walls of the hosts. It was also shown that the nature of the nutrients on which *C. solani* and *M. recurvus* were grown immediately

before contact greatly influenced the degree of parasitism, which required good vegetative growth of both host and parasite. Higher temperatures also increased parasitism, *M. recurvus* being susceptible at 25° to 30° C. and immune at 15°; intense artificial light (but not daylight) suppressed it. The presence of certain fungi inhibited parasitism of *M. recurvus*, but others had no effect.

Isolates of *C. solani* ranged from highly virulent to avirulent. Four physiologic races were recognized on a basis of differential pathogenicity to *Pythium debaryanum* and *Rhizopus* sp. Two isolates of *C. solani* produced basidiospores in culture, believed to be the first report of a basidiomycete parasitizing fungi of the Phycomycetes and Fungi Imperfecti.

It is concluded that the formation of coils at one time and infection hyphae at another is a specific reaction. Furthermore, the manner of attack by *C. solani* appears to depend on both host and parasite. The hyphal coils and infection hyphae seem to be formed as a result of chemical stimuli produced on the surface of the hyphae of both host and parasite, these substances acting in a complementary manner to determine the mode of infection.

In the present study, isolates of *Fusarium lini* were seen to attack the hyphae of *C. solani*, much as the latter parasitized other fungi. Apparently, certain plant pathogens may have two or more systems for parasitism, possibly related to survival, as *F. lini* persists in soil for long periods in competition with other organisms.

White (N. H.). **Antibiosis in plant pathology.**—*Aust. J. Sci.*, 19, 6, pp. 7–9, 1957.

Attention is drawn to the need for a wider but nevertheless precise concept of 'antibiosis', especially in relation to plant diseases. There are apparently three ways, depending on their source, in which antibiotics may modify the pathogen-host relationship. Thus, the pathogen may secrete a substance antagonistic to the host; the latter may produce a substance injurious to certain of its pathogens; and micro-organisms may secrete substances antibiotic to a given pathogen, thereby influencing the incidence and severity of the disease which it causes. Evidence supporting the existence of each of these types of antibiotic action is summarized from 25 contributions to the literature, most of them already noticed in this *Review*.

Panzer (J. D.), Van Arsdel (E. P.), & Tullis (E. C.). **A simple 24-hour spore collector.**—Abs. in *Phytopathology*, 47, 7, p. 453, 1957.

A spore collector is described consisting of an air-tight wooden box with a 6-volt automobile fan fitted in a hole in the top to draw out air and cause a spore-bearing current of air to enter the box through a piece of copper tubing. The spores are caught on slides, greased, and mounted vertically on the metal table of a Taylor dew meter [34, p. 309], exposing a small area of a slide for one hour.

Pady (S. M.). **Quantitative studies of fungus spores in the air.**—*Mycologia*, 49, 3, pp. 339–353, 7 graphs, 1957.

From June, 1953, to June, 1955, a Pady–Rittis spore sampler (*Trans. Kans. Acad. Sci.*, 57, pp. 157–163, 1954), a modification of the Bourdillon slit sampler, mounted 150 feet above the campus of Kansas State College, Manhattan, was exposed for 30 minutes daily in summer and once or twice a week in winter, 256 exposures being made in all.

Fungal spores were present throughout the year, but were seasonal in distribution, with peaks in July and August, and low concentrations in winter. In summer, numbers ranged from 50 to 700 per cu. ft. (occasionally up to 1,300); in winter, the figures were usually 5 to 20.

Cladosporium was the commonest fungus [cf. 35, p. 474; 36, p. 605]. Its occurrence was definitely seasonal, with high variability in numbers from day to day

during summer (usually 25 to 350, but extremes in July ranged from 3·9 to 1080); in winter, numbers were low (mostly 1 to 15), but some were always present.

Ustilago chlamydospores were also present throughout the year, with a peak at harvest; numbers ranged from 3 to 50 (occasionally up to 415) in summer and from 1 to 10 in winter.

Puccinia uredospores were present in June and September, and occasionally at other times [35, p. 362]. Rust spores in general were present only on certain days, daily numbers ranging from 1·2 to 12. *Alternaria* spores were seasonal, numbers ranging from 2 to 40 in summer, with a maximum of 97·8 on 7th July, 1953, and generally absent in winter. Yeast cells, *Fusarium* spores, and basidiospores were definitely seasonal and appeared to be abundant after rain. In addition to 17 other genera listed that were occasionally represented many unidentified spores and hyphal fragments were also trapped.

Gregory (P. H.). **Electrostatic charges on spores of fungi in air.**—*Nature, Lond.*, 180, 4581, p. 330, 1 fig., 1957.

Tests made during 1954–55 showed most freshly discharged spores of *Ganoderma applanatum*, *Agaricus campestris*, *Pholiota squarrosa*, and *Flammula carbonaria* to carry a positive charge. On the other hand, negative charges seem to predominate on basidiospores of *Coprinus micaceus*, *C. hiascens*, and *Polyporus squamosus*.

Haskins (R. H.). **Factors affecting survival of lyophilized fungal spores and cells.**—*Canad. J. Microbiol.*, 3, 3, pp. 477–485, 1 graph, 1957.

At the Prairie Regional Laboratory, Saskatoon, Saskatchewan, the best survival of lyophilized spores of *Alternaria*, *Aspergillus*, *Fusarium*, *Gliocladium*, *Penicillium*, and *Pestalotia*, uredospores of *Puccinia graminis*, *P. helianthi*, and *Melampsora lini*, and budding vegetative cells of *Ustilago* was achieved when the suspensions were frozen just sufficiently to keep them solid until evaporative freezing conditions were reached. Survival was increased by rapid re-warming of the frozen suspensions and by opening the tubes in a moist atmosphere [cf. 33, p. 245].

Sharp (E. L.) & Smith (F. G.). **Further study of the preservation of Puccinia uredospores.**—*Phytopathology*, 47, 7, pp. 423–429, 1 graph, 1957.

Details are presented from Iowa State College, Ames, of the continued study of the authors' lyophilization method for storage of rust spores [cf. 35, p. 818], the data chiefly concerning *Puccinia coronata*. It appears that cold storage is preferable to that at room temperature, and the indications are that spores from the field store better than those from the greenhouse. Large and small samples appear to store equally well; opened lyophil tubes can be stored for a fortnight in small desiccators at 2 to 5° C. without loss of spore viability. Evidence to date (though more is required) indicates maintenance of pathogenicity over storage periods up to five and a half years, and it can in general be expected to be at least four times as long as that possible by cold storage.

Whitehead (M. D.). **Sorghum grain, a medium suitable for the increase of inoculum for studies of soil-borne and certain other fungi.**—*Phytopathology*, 47, 7, p. 450, 1957.

This note from the University of Missouri, Columbia, describes the preparation and use of grain sorghum media, especially useful for culturing mycelia sterilia and organisms such as *Diplodia zeae* in a form giving inoculum readily incorporated with seed in drilling. White-seeded sorghum (preferable to red) is soaked for 12 hours, then with added water autoclaved twice (on consecutive days) in 500 ml. flasks, keeping the grains separate by shaking. After inoculation (followed by

shaking) and subsequent spread of the culture the flasks are again shaken from time to time to prevent matting and to aerate the medium.

Meinecke (G.). **Über Rundzellenvermehrung bei Schimmelpilzen in Submerskulturen.** [On the proliferation of round cells in mould fungi in submerged cultures.]—*Zbl. Bakt.*, Abt. 2, pp. 184–193, 15 figs., 1957.

From the Institute of Hygiene, Hamburg, the author describes an apparatus for agitating liquid cultures, which are accommodated in tall test tubes (340 mm.), sealed with cotton wool. Each tube contains an iron-cored glass plunger, made to rise and fall by an electromagnetic arrangement which permits adjustment of the rate of action and of the length of stroke of the plunger. A long stroke is used where it is desired to increase the aeration of the medium.

In periston (a commercial blood fluid substitute) with added nutrients a strain of *Penicillium glaucum* was induced to grow in the form of dwarf but otherwise normal mycelia, producing few phialides, each with an adherent chain of conidia. In a viscous periston-sugar agar medium of low nutrient status abnormal mycelia developed, consisting of variously distorted cells.

Stille (B.). **Schädigungen an Pflanzenwurzeln durch Kulturfiltrate von Mikroorganismen.** [Injuries to plant roots by culture filtrates of micro-organisms.]—*Arch. Mikrobiol.*, **26**, 1, pp. 71–82, 1 fig., 1957.

Experiments are reported from the Phytopathological Institute of Bonn University, Germany, to determine the influence of culture filtrates of some plant-pathogenic fungi, e.g., *Alternaria solani*, *A. tenuis*, *Pythium debaryanum*, and *Fusarium oxysporum*, and numerous non-parasitic micro-organisms on the roots of young *Lepidium sativum*, flax, pea, and wheat plants [cf. **36**, p. 546].

A high proportion of the filtrates caused severe or at least distinct injury even after an exposure of only two hours. They included those of several strains of *A. solani* from potato tubers (pathogenic to all hosts), two species of *Streptomyces* isolated from soil, *Aspergillus niger*, *A. ochraceus*, *Pythium debaryanum*, *Pseudomonas fluorescens*, *P. pyocyanea*, and *Bacterium prodigiosum* [*Serratia marcescens*] (all tested only on *L. sativum* and flax).

The damage was readily recognizable on application of the tetrazolium test, since the affected portions of the roots lose to a greater or lesser extent the capacity for formazan production which is characteristic of intact material. The loss is accompanied by failure to make further growth, so that the future of the plants is decided by the regenerative activity of the remaining roots.

The only fungal filtrate that inhibited germination was that of *A. niger*, but various bacteria did so, especially *S. marcescens*. A protective mechanism in the seed is thought to be responsible for this partial immunity from the toxins secreted by micro-organisms of the rhizosphere.

Shemahanova (Mme N. M.). Роль микоризообразующих грибов в питании древесных растений. [Rôle of mycorrhiza-forming fungi in the nutrition of woody plants.]—Изв. Акад. Наук СССР. [*Bull. Acad. Sci. U.S.S.R.*], *1957*, 3, pp. 317–330, 1 pl., 4 figs., 1957.

At the Institute of Microbiology, U.S.S.R. Academy of Sciences [? Moscow], filtrates of mycorrhizal fungi were found to stimulate the development of pine and oak and to promote the germination of pine seed and increase the length of the sprout. *Boletus luteus*, *B. bovinus*, and *Cenococcum graniforme* [*C. geophyllum*: cf. **5**, p. 316] secreted pantothenic acid, *B. luteus*, *B. bovinus*, and *B. scaber* nicotinic acid, and *B. luteus* and *B. bovinus* biotin. When these vitamins were added to fertilizers, a similar stimulating effect on germination and sprout length was observed, indicating that vitamins are one of the factors determining the rôle of mycorrhiza in plant nutrition.

Koch (O. G.) & Dedic (G. A.). **Über den Spurenelementgehalt der Konidien von Schimmelpilzen.** [On the trace element content of the conidia of mould fungi.] —*Zbl. Bakt.*, Abt. 2, 110, pp. 178–183, 1 fig., 1957.

The authors used a simple suction apparatus (designed to take up 1 g. of spores for an air intake of only about 5 l. air) to harvest conidia of *Aspergillus niger*, *A. flavus*, *A. clavatus*, and *Citromyces* [*Penicillium*] *decumbens* growing on beer wort agar. Spectrographic analysis of the ash revealed copper, iron, manganese, and zinc in all four species, aluminium only in *A. niger* and *C. decumbens*, and tin only in *A. niger*. The content of both ash and trace elements was higher in *A. niger* than in the other species.

Mulder (E. G.). **Sporenelementen en microorganismen.** [Trace elements and microorganisms.]—*Landbouwk. Tijdschr., 's-Grav.*, 69, 7/8, pp. 575-592, 1957.

This paper from the Institute for Soil Fertility, Groningen, comprises a review of work on the rôle of trace elements (Fe, Mn, Cu, Zn, Co, B, and Mo) in micro-organisms, followed by a short note on methods of study.

Schöller (F.). **Über den Einfluß herzwirksamer Glykoside auf Wachstum und Gesundheit landwirtschaftlicher Nutzpflanzen.** [On the influence of cordial glucosides on growth and health of agricultural economic plants.] –*Z. Acker- u. PflBau*, 101, 2, pp. 465–470, 1956.

Negative results were given by experiments in 1953 and 1954 at the Technical College, Munich, to verify Fahrenkamp's observations regarding the beneficial effects of cordial glucosides on the growth of plants (Vom Aufbau und Abbau des Lebendigen, 1, 2, 3, Hyppokrates-Verlag, Stuttgart, 1937, 1938, 1943). Neither viviflor (Fa. Knoll AG) nor tinctures of *Digitalis*, *Adonis*, *Convallaria*, or *Crataegus* induced a favourable response in barley infected by mildew [*Erysiphe graminis*] and wheat attacked by black rust (*Puccinia* [*graminis*]), irrespective of concentration or mode of application.

Venkata Ram (C. S.). **Fusarinic acid production by Fusarium orthoceras in vitro.**—*Experientia*, 13, 7, p. 284, 1957. [German summary.]

In the course of an extensive study at the University Botany Laboratory, Madras, India, on 23 species of *Fusarium* from the Centraalbureau voor Schimmelcultures, Baarn, the secretion of fusarinic [fusaric] acid by *Fusarium orthoceras* [36, p. 791] was demonstrated by biological methods and paper chromatography. Under the experimental conditions, involving three weeks' maintenance on Richards's solution at a temperature of 27° to 29° C., relatively large quantities of the toxin were produced (300 mg. per l. compared with 65 by *Gibberella fujikuroi* [32, p. 269] and 35 by *F. vasinfectum* [35, p. 386]).

Dulaney (E. L.). **Formation of extracellular lysine by Ustilago maydis and Gliocladium sp.**—*Canad. J. Microbiol.*, 3, 3, pp. 467–476, 1 graph, 1957.

In shaken liquid culture at the Prairie Regional Laboratory, Saskatoon, Saskatchewan, *Gliocladium* sp. and *Ustilago maydis* produced 400 μg. per ml. of extracellular lysine [see below]. This was formed during the early growth stages, concurrently with most of the extracellular organic nitrogen [cf. 35, p. 37].

Richards (M.) & Haskins (R. H.). **Extracellular lysine production by various fungi.** —*Canad. J. Microbiol.*, 3, 4, pp. 543–546, 1957.

In studies at the Prairie Regional Laboratories, Saskatoon, Saskatchewan, 63 of over 600 fungi tested were found to produce detectable amounts of extracellular free lysine [see above] in shaken culture as measured by a turbidimetric bioassay technique. Following adjustment of the cultural conditions, yields of two isolates

of *Ustilago maydis* were increased to 200–300 μg. per ml. The yields of other fungi were increased by the addition of ammonium acetate or acetic acid, or by increasing the amount of urea in the medium from 0·06 to 0·6 per cent.

Köhler (E.). **Untersuchungen zur Frage der Immunität des Kartoffel- 'U.S.D.A. Seedling 41956' gegen das X-Virus.** [Investigations on the question of immunity of the Potato—'U.S.D.A. Seedling 41956' from X virus.]—*Züchter*, 27, 4, pp. 177–179, 1 graph, 1957.

The author reports several experiments to determine the fate of potato virus X inoculated into the immune variety U.S.D.A. Seedling 41956 [cf. 36, p. 172].

In the first experiment 40 leaves were inoculated by rubbing and then divided into five groups of eight. Group one was immediately placed in cold storage at 2° C. Groups two to five, in Petri dishes, were kept in warmth and light for 24 hours and two, four, and eight days respectively, to encourage virus growth, and then likewise put in cold storage. When expressed sap from the groups, prepared on the ninth day, was examined for infectivity to *Gomphrena globosa* only groups two and three gave lesions (one each), from which it was concluded that four days was the maximum survival period in the leaves.

In the second experiment the intact foliage of four plants was inoculated, as uniformly as possible, with infective sap from the tobacco variety Samsun. From one plant all leaves were immediately removed and halved, the pooled halves being tested for activity in *G. globosa*. Half the foliage of the other plants (as half-leaves) was not removed until after 22, 48, and 72 hours, respectively, while half was removed at the outset and kept at 2°. The results, expressed in a logarithmic graph, showed a steady fall of activity in both series of samples, more rapid in the foliage which remained on the plants at normal temperatures [cf. 19, p. 496].

The third experiment compared the fate of the virus in seedling 41956 and in the susceptible *Solanum demissum*—Bastard A 6. Terminal leaves were inoculated and sap samples, prepared after 0, 24, 48, and 72 hours, compared for infectivity to *Nicotiana rustica*. In seedling 41956, in spite of high initial infectivity, there was no activity after 24 hours. In *S. demissum* there was a fall of infectivity during the first 24 hours, but subsequent multiplication followed the curve to be expected in a susceptible host. The fourth experiment was devised to determine whether the sap of seedling 41956 inhibited infection by the virus. Equal quantities of expressed sap from infected Samsun tobacco were mixed with graded quantities of uninfected sap from seedling 41956 in proportions ranging from 1:1 to 1:10, controls being mixed in the same way with like quantities of uninfected sap from Samsun. There was no significant difference in the infectivity of the two series for *Gomphrena*, and as from the author's earlier (unpublished) work Samsun sap is known to have no inhibiting effect on the virus it must be concluded that sap from Seedling 41956 likewise has none.

Bagnall (R. H.), Larson (R. H.), & Walker (J. C.). **Potato viruses M, S, and X in relation to interveinal mosaic of the Irish Cobbler variety.**—*Res. Bull. Wis. agric. Exp. Sta.* 198, 45 pp., 17 figs., 1956. [52 refs.]

This contains a detailed account of investigations on interveinal mosaic and the related potato viruses, already noticed [36, p. 265], with additional data. Mechanical inoculation with sap extract containing virus S [potato paracrinkle virus (str.)], at 20° C., resulted in local yellow spots on *Chenopodium album*; no local symptoms, but a well-defined systemic veinclearing and chlorotic mottle on *Nicotiana debneyi*; a systemic foliar necrosis on *Solanum rostratum*; and necrotic local lesions on guar [*Cyamopsis psoraloides*]. No symptoms appeared on cowpea or *Datura metel*, although virus S became systemic in the latter. Inoculated with virus M, *D. metel* reacted with a local and systemic spotting, cowpea with reddish local lesions, *N.*

debneyi with irregular brownish ring-like local lesions, but without systemic symptoms, and *S. rostratum* with a necrotic streaking of the stem, petioles, and leaf veins. *C. album* developed no symptoms.

Capsicum annuum, *N. glutinosa*, and tobacco were immune from both virus S and virus M. Virus M alone, in sap containing the two viruses, survived 10 min. heating at 65° C. Virus S alone survived 4 days at 20° C.

The great majority of potato varieties from North America and Europe tested were infected, all or in part, with virus S. Varieties free from this virus included Alpha, Jubel, Saco, Sebago, and Voran. Repeated sap and graft inoculations failed to infect plants of the variety Saco with virus S, but it was susceptible to virus M. Viruses M, S, and X were also present in Green Mountain potatoes manifesting the leaf rolling mosaic virus disease [cf. 31, p. 509]. Plants of the varieties Fortuna and King Edward, reported in Europe to harbour strains of virus S, were shown to contain both virus M and virus S. After consideration of similarities and differences, it was suggested that viruses M and S might have had some common ancestor, but that neither could be regarded as a 'strain' of the other.

Certain *Datura* species, *D. bernhardii* in particular, reacted with ring-like local lesions when inoculated with potato sap containing both virus S and virus M. Greater numbers of these lesions appeared if the sap had been heated for 10 min. at 40°–50° C. This phenomenon was termed 'heat activation' and is possibly to be explained on the basis of a heat-labile inhibitor present in the potato sap. Similar results were obtained with respect to virus X inoculum from tobacco, rubbed on *Gomphrena globosa*.

Wetter (C.). **Serologische Untersuchungen über Verteilung und Konzentration des S-Virus in Kartoffelpflanzen.** [Serological studies on the distribution and concentration of S-virus in Potato plants.]—*NachrBl. dtsch. PflSchDienst* (*Braunschweig*), *Stuttgart*, **9**, 6, pp. 82–84, 11 graphs, 1957.

At the Institute for Virus Serology, Federal Biological Institute, Brunswick, tubers of fourteen representative potato varieties infected with potato virus S [potato paracrinkle virus (str.): 35, p. 536; 36, p. 419] were planted on 28th April, 1955, and the concentration of the virus in the foliage from the base to the growing point was determined after approximately 65 days (i.e., before flowering) and 108 days (during or after flowering). It was apparent that generally the fully developed leaves immediately behind the growing point have the highest concentration, which falls sharply in the lower leaves, reaching nil in some cases. This effect was clearly to be seen in Apta (both inspections), Fortuna (second inspection), Monika (both), Virginia (first), Heida (first), and Erstling (first), but there were marked exceptions, as for instance in Virginia (second inspection), where the highest concentration was in the three or four basal leaves, falling sharply in the fifth to eighth, and showing only a slight rise in the ninth to eleventh (the twelfth being terminal). The average foliage concentrations for the different varieties at the two inspections are presented graphically, and in each case were higher at the second date than that at the first; the difference varied widely, but averaged 50 per cent.

The observation that the concentration was in general highest in the subterminal leaves, irrespective of the time of inspection, stands in contrast to Bartel's findings with potato virus X [35, p. 317], which accumulated markedly in the upper leaves during the flowering period. The levels of virus S encountered in the present study were altogether lower than his. Virus S was also present in samples of upper stem (74 per cent. positive; average titre 1:4), and in root tips (average titre 1:2·5).

It is concluded that leaves for serological demonstration of this virus should be taken at or before flowering from below the youngest fully expanded leaf on each shoot, and samples from several shoots should be pooled.

Köhler (E.). **Ergänzende Notizen über das K-Virus (Rollmosaic) der Kartoffel (syn. Solanum virus 11 K.M. Smith = Potato E-virus Dykstra).** [Concluding notes on K-Virus (Roll mosaic) of Potatoes (syn. *Solanum* virus 11 K.M. Smith = Potato E-virus Dykstra).]—*NachrBl. dtsch. PflSchDienst (Braunschweig), Stuttgart*, 9, 6, pp. 84–85, 1957.

In completion of his studies on potato virus K [potato leaf rolling mosaic virus: 23, p. 186], the author reports that the thermal inactivation point (for 10 min. exposure in expressed sap from a systemically infected plant of *Solanum demissum*) was 73° C. The 'aurea' symptoms [loc. cit.] encountered in two plants inoculated by means of infected aphids were due not to virus K but to a strain of potato virus Y, present in the tubers, which was assumed to have inhibited the former virus.

Valenta (V.). **Hexenbesenkrankheit der Kartoffel in der Tschechoslowakei (Beitrag zur Frage des 'Nord-Stolbur').** [Potato witches' broom disease in Czechoslovakia. (Contribution to the question of 'northern stolbur').]—*Biológia, Bratislava*, 11, pp. 449–456, 1956. [Abs. in *Z. PflKrankh.*, 64, 7–10, p. 642, 1957.]

Potato plants showing the characteristic symptoms of potato witches' broom virus are reported to be common in Czechoslovakia. The author regards the disease as identical with 'northern stolbur' [35, p. 726]. Since the geographical distribution of 'northern' and 'southern' stolbur overlaps in many areas, it is proposed to substitute the term 'witches' broom' for 'northern stolbur'. Although the symptoms of 'northern' and 'southern' stolbur are practically indistinguishable on tomato, they differ so markedly on potato, eggplant, *Nicotiana glutinosa*, and tobacco as to suggest the implication of distinct viruses rather than strains of a single one.

Hey (A.). **Zur Rassenanalyse des Kartoffelkrebses (Synchytrium endobioticum (Schilb.)) Perc.** [On the racial analysis of Potato wart (*Synchytrium endobioticum* (Schilb.)) Perc.]—*Z. PflKrankh.*, 64, 7–10, pp. 452–457, 2 maps, 1957. [English summary.]

Since the last information on the biology of potato wart (*Synchytrium endobioticum*) in Germany was issued from the Biological Institute [33, p. 14], three new foci have been established, bringing the total number of independent physiologic races in the German Democratic Republic to five (besides the so-called 'normal' type). Since the last-named was shown by inoculation experiments on an assortment of indigenous and foreign varieties to be equally aggressive in the majority of cases with the supposedly more virulent biotypes, it is proposed to replace the designation 'normal type' by the symbol D_1 (Dahlem) and to name each of the others by the initial letter of their place of origin, i.e., G_1 (= Giessübel), P_1 (= Pappenheim), K_1 (= Koppatz), R_1 (= Rudolstadt), and E_1 (= Eulendorf).

Andrén (F.) & Olofsson (B.). **Besprutningsförsök mot Potatisbladmögel 1956.** [Spraying experiments against Potato blight 1956.]—*Växtskyddsnotiser, Stockh.*, 21, 2, pp. 23–26; 3, pp. 42–47, 1957.

A tabulated survey is given of the data obtained from spraying experiments against potato blight [*Phytophthora infestans*] carried out on the Up-to-Date variety at the headquarters of the Swedish Plant Protection Institute and at the Åkarp (Malmö) branch [cf. 35, p. 787]. The gross yields from plots treated with carbamate preparations based on zineb, manzate, and nabam were somewhat higher than those resulting from the application of copper sprays. The difference, however, may be attributed less to a stimulatory action of the carbamates than to an aggravation of the adverse effects of copper on growth through the dull summer. Of the copper

compounds tested, copper oxychloride (6 kg. per ha.) proved rather superior to copper oxide at 4 kg. but Bordeaux mixture again maintained its reputation as the most effective fungicide against *P. infestans*.

Spraying experiments were also organized during 1956 in different parts of the country by the Potato Blight Research Group, using the King Edward, Magnum Bonum, Bintje, and Craigs Defiance varieties. The results of tests comparing the efficacy of one early treatment followed by two on the normal dates with the latter only, using copper compounds throughout, indicated that the former schedule reduced the incidence of both top and tuber infection by about 50 per cent. more than the latter.

Two applications either of copper or De Zäta 78 (zineb) proved inadequate against top infection; where three or four were given, the former was more effective. Copper gave uniformly better results than zineb against tuber rot, which was equally well controlled by two or more treatments. In one locality where blight assumed a virulent form the protective action of two applications of copper was equivalent to that of three with zineb.

On an average, zineb produced substantially heavier gross yields than the copper compounds, comprising Bordeaux mixture (1·2:0·6:100) and the copper oxychlorides cuzol 50, herusit 50, and vitigran at dosages of 6 kg. per ha., but attention has already been drawn to the influence of the sunless summer in this connexion.

It would seem from these observations that the drawbacks incidental to both groups of fungicides may, generally speaking, be obviated by using them in combination—zineb for the first one or two and copper compounds for the later treatments.

Mildio da Batateira e do Tomateiro. [Mildew of the Potato and of the Tomato.]—*Gaz. Agric. Moçamb.*, 8, 85, pp. 162–164, 169, 1 fig., 1956.

Well-known information is presented in semi-popular terms on the occurrence of *Phytophthora infestans* on potato [36, p. 540] and tomato [35, p. 509] in Mozambique. Full instructions are given for the preparation and application of Bordeaux mixture for the control of potato blight. On tomato the fungus is most effectively combated by dithane Z-78 at a strength of 200 gm. per 100 l.

Raeuber (A.). **Über die Bedeutung des Sporenfluges von Phytophthora infestans für den Warndienst.** [Concerning the importance of spore liberation in *Phytophthora infestans* for the warning service.]—*NachrBl. dtsch. PflSchDienst, Berl.*, 11, 1, pp. 6–11, 1 diag., 1 map, 1957.

The results of spore-trap counts at 13 observation posts in East Germany confirmed a positive correlation between an increasing number of spores in the air, critical weather conditions [cf. 35, p. 537], and outbreaks of potato blight. Outbreaks followed seven to ten days after the coincidence of favourable conditions, and it is concluded that they can be accurately forecast in East Germany. For a reliable service traps would need to be operated from mid June at two or three points in every district, the slides being examined at a central laboratory. In dust free higher regions it might be possible to obtain more reliable counts with suction traps.

Müller (K. O.). **Wound healing of the Potato tuber in relation to infection by Phytophthora infestans (Mont.) De Bary.**—*Aust. J. biol. Sci.*, 10, 2, pp. 189–196, 1 graph, 1957.

At the Division of Plant Industry, Canberra, Sebago potato tubers were cut longitudinally and after various intervals at 20° C. inoculated on the exposed surface with a zoospore suspension of *Phytophthora infestans* [36, p. 207]. The protective action of healing tissues against infection was apparent in two ways.

In the tissues adjacent to the injured surface the rate of reaction to the pathogen (as shown by the production of necrotic changes) increased with increasing time between injury and infection, while the development of aerial mycelium on the inoculated surface decreased, sporangiophore production ceasing completely after four days. Marked decrease in susceptibility to infection became apparent before the onset of cell division in the tissues that would later form wound periderm. The probability of an individual spore being able to penetrate the protective barrier of wound periderm was decreased by at least 92 per cent. when six days intervened between injury and inoculation.

Two hypotheses are put forward: (1) that mechanical injury increases sensitivity towards the parasite in the tissues adjacent to the injured face; and (2) some mechanical factor, possibly a deposition of suberin, impedes penetration. The results suggest that the importance of the concentration of zoospores in the soil depends largely on the rate with which wound periderm is formed; in late autumn, when it forms slowly, differences in spore load may be insignificant unless the concentration is low. In early autumn, when periderm develops more rapidly, a reduction in the population of the pathogen can markedly affect the incidence of tuber blight infections established after lifting. This may partly explain why the preventive effect of spraying the crop with sulphuric acid varies so widely with the date of sowing.

Zeck (W.). **Untersuchungen über Infektionsverhältnisse bei der Phytophthora-Knollenfäule und über deren Beeinflußbarkeit durch Kupferdüngung.** [Studies on infection relations in the *Phytophthora* tuber rot and on its amenability to influence by copper fertilizing.]—*Phytopath. Z.*, **29**, 3, pp. 233–264, 10 figs., 2 graphs, 1957.

From studies undertaken at the Phytopathological Institute, University of Bonn, and at the experimental farm of the Chamber of Agriculture, Wahn, Germany, to elucidate obscurities in the mode of potato tuber infection by *Phytophthora infestans* it was concluded that infection is caused by spores which are formed on the leaves and washed down into the soil on to the tubers. Downward growth of hyphae from infected leaves through stems and stolons to the tubers was not observed.

The nature and intensity of infection depend on the state of maturity of the tubers, young ones [33, p. 374] being very readily attacked at the 'eyes', lenticels [3, p. 421], and probably through the still labile cork layer [cf. 6, p. 48]. Mature tubers can be infected only at the 'eyes' and hilum, and in isolated instances through the lenticels after protracted exposure to the fungus. The stolons are very susceptible and open to the hyphae a route of rapid progress to the tubers. The pathogen also favours as channels of ingress the lenticular excrescences which develop spontaneously, especially on young tubers, in damp, poorly aerated clay soils and may be artificially induced by several weeks' storage of harvested tubers in moist, sterile peat mould.

Soil particle size and pore space arrangement exert a strong influence on the severity of infection by *P. infestans*, finely sifted, sandy soil being particularly permeable.

Neither in pot nor in field experiments did soil amendments with up to 500 or 800 kg. copper sulphate per ha. effect a significant reduction of tuber infection [36, p. 268]. The copper was subjected to powerful binding forces in the soil, only 1 in 10 to 1 in 100 parts of the amount applied being available to the plants and not more than about 1 in 1,000 detectable in the soil solution. The latter fraction, moreover, was largely inactivated, only one-eighth of the quantity applied being fungicidally active in spore germination tests. On this basis it would appear impracticable to provide the soil with a sufficiency of fungicidally active copper, and spraying with the element for the control of aerial infection consequently remains the most effective method of tuber rot prevention.

Schmiedeknecht (M.). **Beitrag zur Morphologie und Cytologie von Colletotrichum atramentarium.** [Contribution to the morphology and cytology of *Colletotrichum atramentarium*.]—*Phytopath. Z.*, 29, 3, pp. 339–345, 4 figs., 1957.

Continuing his studies at the Institute for General Botany of the Friedrich Schiller University, Jena, Germany [35, p. 541], the author seeks to remedy the existing confusion between *Colletotrichum atramentarium*] and similar species by the elucidation of obscure features in its morphology and cytology.

The conidia are cylindrical with an obtusely conical rounding of the tips. They are mostly straight, with the basal end sometimes narrower than the apical. Appearing hyaline individually, the conidia are reddish to yellow in the mass. A central zone, staining vividly with aniline blue, was shown by the application of Heidenhain's and Feulgen's reagents to contain a nucleus, averaging 1·5 to 1·7 μ in diameter, embedded in plasma. In over-mature conidia a cross wall is often formed before germination, and in such cases the daughter nuclei remain lying near it for a time. Right and left of the nucleus in older, unicellular conidia lies a fair-sized vacuole. The plasma is mostly concentrated round the nucleus and at both ends of the conidium. It is granulated and a strongly refractive droplet is frequently observed, especially at the poles. The plasma stains deep yellow to red with Sudan III while the vacuoles remain colourless.

The germ-tube is formed in one corner of the conidium or occasionally one develops at each end. In pure culture the spores are abstricted directly from the mycelium, whereas in nature they are produced in the black, sclerotioid structures (acervuli) occurring in profusion on withered potato plants. They arise from conglomerations of swelling and anastomosing hyphae. The external hyphae fuse into a pseudoparenchymatous peridium, while the interior of this sclerotial stroma consists of a prosenchyma. At first the hyphae are colourless and full of oil drops, but the membranes gradually darken and ultimately turn black, beginning with the peridium and proceeding inwards.

The stroma is studded with a continuous palisade of hyaline, simple, cylindrical conidiophores with a dentate or rounded apex and up to three septa. The conidia are abstricted singly from the apex of the conidiophore. Hyaline, later black, pluriseptate, straight or curved setae emerge between the conidiophores from a swollen basal cell in the prosenchyma of the stroma of the acervulus.

The acervuli are mostly formed in the epidermal cells and erupt at maturity. When the host dies quickly and the pathogen develops rapidly in consequence, the stroma remains small and the bulk of the acervulus is constituted by the sterigmata and setae. When development proceeds more slowly the stroma is predominant and tends to assume considerable proportions. As a rule, only sclerotia without setae or conidiophores are formed in culture, but transference of the sclerotia to the host results in the production of sporulating acervuli.

As in most fungi, the mycelium of *C. atramentarium* is not particularly characteristic. In the host the hyphae are often somewhat constricted at the many septa and may consequently appear almost nodulated. The cells react to their entry by lignituber formation. The development of appressoria is initiated by the clavate swelling of the hyphal tips and their separation by means of a septum from the rest of the mycelium. One or more strongly refractile droplets may very often be detected in the centre of the appressoria, which range from 12 to 14 μ in diameter and are frequently cordate. It is not uncommon in hanging drops to see numerous appressoria uniting into a hypha.

Andrén (F.) & Olofsson (B.). **Kombinerat betnings- och besprutningsförsök mot ringröta på Potatis.** [Combined disinfection and spraying experiment against Potato ring rot.]—*Växtskyddsnotiser, Stockh.*, 21, 2, pp. 26–27, 1 fig., 1957.

At the Swedish Plant Protection Institute near Stockholm in 1956, 600 King

Edward potato tubers were selected at random from a consignment fairly heavily infected by ring rot [*Corynebacterium sepedonicum*: 35, p. 789] and immersed for one hour in actidione at a concentration of 100 mg. per l., the same number being treated with water only. All the tubers were planted out in plots (100 in each) and three plots of each group sprayed three times with actidione (25 p.p.m.). About three weeks before lifting the haulms in half of each plot were killed with 10 per cent. sulphuric acid.

From a detailed analysis of the state of the tubers after two months' storage in a cellar it appeared that immersion in the antibiotic reduced the incidence of ring rot on an average by some 45 per cent., but neither spraying with actidione nor haulm-killing was effective by itself.

Lihnell (D.). **Några olika Potatissorters förhållande till ringröta.** [The reaction of some different Potato varieties to ring rot.]—*Växtskyddsnotiser, Stockh.*, 21, 2, pp. 28–30, 4 figs., 1957.

Experiments were performed in 1956 at the Swedish Plant Protection Institute to determine the reactions of 14 potato varieties to ring rot [*Corynebacterium sepedonicum*: see preceding abstract]. Five out of 10 tubers of each variety were inoculated with a bacterial suspension from King Edward with typical symptoms and planted out, together with the controls, a week later, on 25th May.

The type of wilting in the infected plants was variable. In Bintje, Eigenheimer, and Eva, for instance, the leaves became limp and rolled inwards, the interveinal areas not infrequently being yellow-mottled. The flaccidity increased, the leaves drooping down the stalks and eventually withering completely. In other varieties, e.g., Ackersegen and Sandnudel, the symptoms were more reminiscent of black leg [*Erwinia phytophthora*]. In the final stages there was little external difference between the infected plants and dead ones in general. In fact, the ring-rot wilt, apart from the presence of bacteria in the vascular bundles of the stem, was practically non-specific, and its symptoms would probably not be noticed in an ordinary potato crop, especially in varieties like Birgitta and King Edward, which do not begin to wilt until senescence.

After lifting on 4th to 5th October the tubers were stored in a cellar until 7th November. They were then examined (and again five weeks later) for symptoms of ring rot. Most of the varieties were severely infected, exceptions being Alpha, Elsa, Anna, and President. In a parallel test by the Agricultural Society at Kristianstad Craigs Defiance and Up-to-Date sustained heavier damage than Dianella. Ring rot, however, is a typically partial disease, an infected tuber generally giving rise to a plant with only some wilted stems and decayed tubers, the others being apparently healthy. Moreover, a plant, e.g., of Ackersegen or Magnum Bonum, may produce infected tubers without any aerial symptoms, while conversely, wilting may occur, as in Alpha and Majestic, with no apparent damage to the tubers. An unusual feature of the Stockholm tubers, possibly due to excess of water in the soil, was the penetration of the bacteria from the hilum, not only into the vascular ring but also directly into the flesh, which was more or less discoloured and of a boiled consistency.

Epps (W. M.). **Control of Potato seed piece decay in South Carolina 1952–1956.**—*Plant Dis. Reptr*, 41, 3, pp. 148–150, 1957.

Tests were carried out at the Clemson College Truck Experiment Station, Charleston, South Carolina, during 1952–56 on the effects of chemical treatment and corking of potato seed pieces on decay caused by *Erwinia atroseptica* [36, p. 348] and *E. carotovora* [36, p. 267]. In 1956 when Sebago was grown in plots which received two irrigations of approximately 1·25 in. each, one and five days

after planting, the conditions favouring seed piece decay, stand, and yield were increased considerably by all the treatments.

Streptomycin used as a dip at 100 and 50 p.p.m. or as a dust at 0·05 to 0·2 per cent. on freshly cut pieces gave good control and was more effective than captan (2 lb. 75 per cent. in 100 gals. water or 7½ per cent. dust) or the practice of cutting the tubers a week before planting to allow the cut surfaces to cork over. Agromycin 100 and American Cyanamid streptomycin appeared superior to phytomycin, which caused a progressive yield decrease in non-irrigated plots. Streptomycin increased yield slightly in the non-irrigated plots, as did captan dip, but captan dust caused a slight decrease. Throughout the treatments improvement in yield was greater than that in stand, yield increases in the irrigated plots in 1956 for corked and streptomycin treatments being 56·2 and 85·4 per cent. over the untreated, while stand increases were 17·3 and 29·7 per cent., respectively.

Hildebrand (E. M.). **Dissemination of Sweetpotato cork virus in nature. Freeing Sweetpotato varieties from cork virus by propagation from tip cuttings.**—Abs. in *Phytopathology*, 47, 7, p. 452, 1957.

In the first of these two abstracts it is shown that rapid spread of sweet potato [internal] cork virus [36, pp. 208, 270] is due to insect vectors. Studies at Beltsville, Maryland, in 1955, showed, by the presence of chlorotic spots on the first flush of growth, that some sprouts from symptomless roots were infected. Similar spots appearing two months later on hitherto symptomless plants indicated insect transmission, and there was considerable spread from one row to another in plots. Initially healthy rows adjoining a row planted with diseased stock sometimes acquired over 40 per cent. disease during the season.

The second abstract describes the procedure to obtain sweet potato plants free from internal cork virus by propagating the tips of shoots that are symptomless after a three weeks' flush of growth, and repeating this a second time, plants still symptomless being free from the virus.

Neufeld (H. A.), Latterell (Frances M.), & Weintraub (R. L.). **Polyphenol oxidase in Piricularia oryzae.**—Abs. in *Fed. Proc.*, Part I, 15, p. 320, 1956.

At Camp Detrick, Frederick, Maryland, the production of polyphenol oxidase activity was investigated in two strains of the rice blast fungus, *Piricularia oryzae* [see next abstract], in liquid cultures. Homogenates prepared from acetone powders of the mycelium of either strain proved to be capable of oxidizing a number of phenolic compounds, including catechol, hydroquinone, phloroglucinol, resorcinol, and *p*-cresol, as well as *o*- and *p*-phenylenediamine. The enzyme also occurs in soluble form in the medium. One of the strains, which secretes a black pigment, oxidizes phloroglucinol appreciably faster than catechol, hydroquinone, or *p*-phenyldiamine. The other strain, a mutant derived from the first, secretes a reddish-brown pigment and oxidizes catechol, phloroglucinol, hydroquinone, and *p*-phenyldiamine at approximately equal rates. Both strains oxidize resorcinol more slowly than the other four compounds. The capacity of these preparations to oxidize the *m*-, di-, and triphenols, resorcinol, phloroglucinol, and monophenols distinguishes the enzyme of *P. oryzae* from both tyrosinase and laccase.

Neufeld (H. A.), Green (L. F.), Latterell (Frances N.), & Weintraub (R. L.). **Oxidation of certain thio compounds by preparations from Piricularia oryzae.**—Abs. in *Fed. Proc.*, Part I, 16, p. 226, 1957.

Several classical inhibitors of copper-containing enzymes were used in further investigations of the polyphenolases of *Piricularia oryzae* [see preceding abstract]. Low concentrations of cyanide and azide were highly effective, whereas sodium diethyldithiocarbamate not only failed to suppress but in some cases stimulated

oxygen consumption. Preparations from *P. oryzae* were shown to contain an enzyme capable of oxidizing sodium diethyldithiocarbamate to tetraethylthiuram-disulphide [thiram]. Sodium diethyldithiocarbamate, several xanthates, and thioacetic acid were also oxidized by the rice blast enzyme, but cysteine, glutathione, thiourea, thioglycolic acid, thioglycerol, and mercaptosuccinic acid were unaffected. Cyanide and azide inhibited the oxidation of sodium diethyldithiocarbamate. Hydrogen peroxide does not appear to be produced in the reaction.

Lockard (R. G.). **The foliar symptoms of deficiencies of the major elements in Rice.** —*Malay. agric. J.* 39, 4, pp. 268–276, 3 col. pl., 1956. [Received August, 1957.]

Most of the information in this paper on sand-culture experiments conducted in the Federation of Malaya to record the foliar symptoms of nitrogen, phosphorus, potassium, calcium, and magnesium deficiency in rice has already been noticed [36, p. 270]. In an experiment using three other varieties (Pebifun, Serendah Kuning, and Radin Siak 34) certain differences from the symptom expression of Siam 29 [loc. cit.] are noted. Coloured plates illustrate the symptoms described, and the results of leaf analyses are tabulated and discussed.

Evatt (N. S.) & Atkins (J. G.). **Chemical control of straighthead in Rice.**—*Rice J.*, 60, 5, pp. 26–27, 32, 1957.

This information has already been noticed [36, p. 663].

Stevenson (I. L.) & Chase (F. E.). **Microbiological studies on an orchard soil under three cultural practices.**—*Canad. J. Microbiol.*, 3, 2, pp. 351–358, 4 graphs, 1957.

Studies at the Ontario Horticultural Experiment Station, Guelph, of a peach orchard soil [cf. 36, p. 476] under mulch, sod, or clean cultivation treatments in part concerned the fluctuations in numbers of fungi, actinomycetes, and bacteria over a period of 15 months. There were definite seasonal changes in the numbers of fungi and bacteria under all three treatments, peaks occurring in February and September, but the numbers of actinomycetes varied little with the seasons.

Garrett (S. D.). **Effect of a soil microflora selected by carbon disulphide fumigation on survival of Armillaria mellea in woody host tissues.**—*Canad. J. Microbiol.*, 3, 2, pp. 135–149, 1957.

After reviewing earlier references to the parasitization of other soil fungi by *Trichoderma viride*, the writer describes experiments at the Botany School, Cambridge University, in which with the use of a technique already described [35, p. 706], Bliss's hypothesis regarding the relation of carbon disulphide fumigation to the killing of *Armillaria mellea* by *T. viride* [30, p. 608; 35, p. 487] was in the main confirmed. When soil was treated with higher concentrations of carbon disulphide fungi even more resistant than *T. viride*, including ascosporic *Penicillia* of the *P. luteum* series, were selected.

Small woody inocula of *A. mellea*, incubated for three weeks in soil fumigated three weeks previously with carbon disulphide at 828 p.p.m. failed to form rhizomorphs in fresh soil. It was considered, however, that the indirect effect of soil fumigation did not account entirely for the destruction of *A. mellea* in the soil and that carbon disulphide damaged at least the peripheral mycelium in the host and facilitated invasion by *T. viride* and possibly other pathogenic fungi.

Gattani (M. L.). **Studies on the control of damping-off of Safflower with antibiotics.** —*Plant Dis. Reptr*, 41, 3, pp. 160–164, 1 fig., 1957.

At the Science Service Laboratory, Lethbridge, Alberta, filipin [35, p. 32] was used in studies on the control of the damping-off phase of root rot of safflower caused

by *Pythium* sp. Seed treatment was ineffective, but when the roots of seven-day-old seedlings grown in sterile soil were soaked in 50 p.p.m. filipin for 72 hours before transplantation to *P.*-infested soil in pots, 63·3 and 43·3 per cent. of the seedlings survived after four and six weeks, respectively, as against 5 and 2·5 per cent. for the untreated. Some stunting occurred, but after four weeks growth was normal.

Pre-emergence damping-off was effectively controlled by irrigation of infested soil with 50 p.p.m. filipin each day for three days after sowing, the surviving stand in the pots being 60·2 and 43·8 per cent. after three and six weeks, respectively, as against 5·1 and 3·0 per cent. for the non-irrigated controls.

Heim (R.). **Les champignons d'Europe. Tome I. Généralités. Partie descriptive : Ascomycètes.** [The fungi of Europe. Volume I. Generalities. Descriptive part: Ascomycetes.]—327 pp., 24 pl. (4 col.), 76 figs. **Tome II. Partie descriptive: Basidiomycètes.** [Volume II. Descriptive part: Basidiomycetes.]—571 pp., 52 col. pl., 256 figs., Paris, Éditions N. Boubée & Cie, 1957. Fr. 7,500 (2 vols.).

This general introduction to the study of the higher fungi, based largely on personal observations and expressing personal views, is intended to meet the needs of the amateur French mycologist. The descriptions have purposely been made as simple as possible; no use is made of dichotomous keys, the principal species being grouped together within each genus in easily recognizable sections. The conventional diagnosis is replaced by a succinct description of the salient features of a species.

The first volume comprises 12 chapters dealing, respectively, with the definition, limits, and affiliations of fungi; the relations between fungi and their environment; the external constitution of the fungus; notes on anatomy and microscopy; sensitive characters (consistency, colour, taste, odour, bioluminescence); toxic fungi; harmful fungi (attacking dwellings, trees, timber); amateur cultivation of edible fungi; the elements of mycogastronomy (with recipes); the true discomycetes; subterranean or tuberoid ascomycetes; and pyrenomycetes.

The second volume comprises seven chapters covering, respectively, Heterobasidiomycetes; Aphyllophorales; Boletales; Asterosporales; Agaricales, preceded by a table recapitulating the families, genera, and sub-genera; Gasteromycetes; and sterile forms. There is a note on how to use the book (pp. 514–516), a bibliography, and an alphabetical index. There are many illustrations, including excellent plates in colour and photogravure.

Tarr (S. A. J.). **The fungi and plant diseases of the Sudan.**—127 pp., 75 figs., 1 map, Kew, Commonwealth Mycological Institute, 1955. 25*s*.

Much of the material from which this annotated list of fungi and plant diseases in the Sudan was compiled has been noticed in this *Review* [35, p. 879 *et passim*]. Following a general introduction to the vegetation and climate of the area and the numbers and distribution of the fungi occurring there, these are listed in systematic order. Short sections are devoted to algae, bacteria, viruses, and non-parasitic disorders. There are indexes of genera and of hosts and substrates. All records collected prior to 1953 are included.

Greene (H. C.). **Notes on Wisconsin parasitic fungi. XXII.**—*Trans. Wis. Acad. Sci. Arts Lett.*, 45, pp. 177–191, 1956.

Among the records of Wisconsin parasitic fungi [cf. 36, p. 554] collected during 1954–55 are: *Sphaerotheca humuli* on *Physocarpys opulifolius*, producing witches' brooms of the lateral twigs which become stiffly elongated and upright; *Cladosporium humile* (the conidial state of *Venturia acerina*) on the periphery of tar spots (*Rhytisma acerinum*) on leaves of *Acer saccharinum*; *Microsphaera euonymi* on *Euonymus europaeus*; *Rhizosphaera kalkhoffii* on *Picea glauca*, causing destructive

needle cast of large specimen trees; *Colletotrichum lucidae* n.sp. (conidia hyaline, cylindrical, 13–19 × 4–6·5 μ) on living leaves of *Salix lucida*; and *Cladosporium coreopsidis* n.sp. (conidia catenulate, smooth, pale smoky brown, 1-septate or continuous, 13–20 × 3·5–4 μ) on living leaves of *Coreopsis palmata* and associated with pronounced stunting and suppression of flowering.

Guyot (A. L.). **Les Urédinées (ou rouilles des végétaux). III. Uromyces.** [The Uredinales (or plant rusts). III. *Uromyces*.]—(*Encycl. mycol.* 29), 647 pp., 78 figs., 65 maps, Paris, Paul Lechevalier, 1957. Fr. 8,500.

This part of the author's important monograph [31, p. 146] deals with *Uromyces* species with teleutospores on leguminous plants, their systematy, morphology, biology, hosts, and geographical distribution. Indexes to the genera and species of the rusts cited and to the hosts are provided.

Săvulescu (T.). **Beitrag zur Systematik der Ustilaginales.** [Contribution to the systematy of the Ustilaginales.]—*Sydowia, Beih.* 1, pp. 64–83, 1957. [52 refs.]

This is an exhaustive discussion on the relation of palaeontology to the phylogeny of the Ustilaginales [cf. 35, p. 490]. Schemes of classification are divided into two groups, one based on the axiom that the promycelium (phragmobasidium) is a primitive organ, and the other that it is derived from the holobasidium and that phragmobasidiomycetes have attained a higher level of development.

Bystricky (V.). **Zur Feinstruktur der Stäbchen des Tabakmosaikvirus.** [On the fine structure of the rods of Tobacco mosaic virus.]—*Z. Naturf.*, 12, 2, pp. 118–119, 1 pl., 1 fig., 1957.

From the Virological Institute, the Czechoslovakian Academy of Science, Bratislava, the author reports an electron-microscopic study of tobacco mosaic particles [cf. 36, p. 132] swollen by the action of water or dilute ethyl alcohol at 37° C.

On some of the particles treated in alcohol an 'oblique striping' could be made out, caused by a narrow furrow running in a shallow spiral round the rod. It was estimated that the width of the furrow would be about 22 A in an untreated rod [cf. 34, p. 551]. Under both treatments uneven swelling led to the development of forms resembling strings of pearls. Examination of fragments confirmed that the intact rod has a central cavity.

Newmark (P.) & Myers (R. W.). **Degradation of Tobacco mosaic virus by alkanolamines.**—Abs. in *Fed. Proc.*, Part I, 16, p. 226, 1957.

At the Department of Biochemistry, University of Kansas, amino alcohols with the general formula R′ R″ CNH CH OH proved singularly effective in the degradation of tobacco mosaic virus [36, p. 133 *et passim*] into its protein and nucleic acid moieties. The extent of aggregation of the protein degradation product, like that of the nucleic acid-free abnormal protein [34, p. 617 *et passim*], was affected by ionic strength, pH and temperature of the buffer, and protein concentration and age of the solution. With alkanolamine buffers kinetic studies of tobacco mosaic virus degradation can be conducted under conditions permitting no reaggregation of the degraded protein.

Dialysis of a 1 per cent. virus solution against 0·02 M ethanolamine at pH 10·5 for 24 hours at 0° to 5° C. yields a single symmetrical peak of low molecular weight in the ultracentrifuge. Only traces of residues of high molecular weight and dimensions corresponding to tobacco mosaic virus can be detected. Although the protein sub-unit obtained by this procedure is smaller than Schramm's 'A-protein' [35, p. 243], it still recombines with tobacco mosaic virus nucleic acid to produce infective virus-like particles.

Bartels (W.). **Untersuchungen über die Beeinflussung der Aktivität des Tabakmosaikvirus durch verrottende Pflanzensubstanzen.** [Studies of the influence of rotting plant substances on the activity of Tobacco mosaic virus.]—*NachrBl. dtsch. PflSchDienst, Berl.*, 11, 4, pp. 61–66, 1957.

The results are presented of further investigations on the inactivation of tobacco mosaic virus [35, p. 331], in this case to determine the action of plant substances under conditions simulating those in a compost heap.

The materials examined, which were mostly green, yellowing, or dried leaves from various sources, were placed in pots 22 cm. in diameter (18 pots of each source) with or without soil, and with or without quicklime at 2 or 20 g. per pot. The virus inoculum, consisting of pieces of infected Samsun tobacco leaves or strips of filter paper containing a known amount of virus, was placed in 'perlon' bags in the material (ten bags per pot). The filled pots were buried to the rim in open land and covered by similar pots, and also by straw in winter. After 12 months the infected samples were tested for activity by abrasion of *Nicotiana texana* [35, p. 332], and where infectivity persisted the test was repeated at 18 or 21 months. The extent of rotting was estimated at the same time.

In only 39 out of a total of 780 pots were samples active after 12 months, and in only 9 after 18 or 21 months, showing the duration of exposure to be of importance. The inactivation of the virus was not correlated with the extent of rotting, and the nature of the composting material appeared to be the primary factor, though the rotting process, involving the release of inhibitory substances, might play a subordinate role. Even where active virus remained it would tend to be diluted below its infection threshold value in the composting process.

Benda (G. T. A.) & Naylor (A. W.). **On the Tobacco ring-spot disease. II. The delayed local lesions.**—*Amer. J. Bot.*, 44, 5, pp. 443–448, 11 figs., 1957.

Earlier work [34, p. 111] on tobacco ring spot virus showed that once the infection had become systemic young leaves developed without symptoms. These were termed 'recovered' leaves.

In the present experiments the symptoms in inoculated immature leaves were studied under various conditions of light and temperature. The basic symptom was a ring of necrotic tissue, varying considerably in diameter according to the environmental conditions, surrounding infected but apparently healthy tissue. The authors attribute the absence of symptoms from 'recovered' leaves to a complete invasion of the very young leaf before symptoms can develop. In this view the entire leaf is thus comparable with the apparently healthy tissue within a necrotic ring.

Kincaid (R. R.) & Gammon (N.). **Effect of soil pH on the incidence of three soil-borne diseases of Tobacco.**—*Plant Dis. Reptr*, 41, 3, pp. 177–179, 1957.

In further experiments at a Florida agricultural experiment station, the incidence of tobacco black shank (*Phytophthora parasitica* var. *nicotianae*) [34, p. 552] continued to vary directly with soil pH in the susceptible variety 870 during 1955 and 1956. In the moderately susceptible Connecticut 49, the resistant Rg, and the highly resistant Dixie incidence rose with increasing pH to 5·5–5·7, but above this no significant difference was observed.

Scheffer (R. P.). **Analysis of Fusarium resistance in Tomato by grafting experiments.**—*Phytopathology*, 47, 6, pp. 328–331, 2 figs., 1957.

This study at Michigan State University, East Lansing, with tomatoes susceptible and resistant to *Fusarium oxysporum* f. [*F. bulbigenum* var.] *lycopersici* has already been noticed [36, p. 430].

Smith (G. E.). **Inhibition of Fusarium oxysporum f. lycopersici by a species of Micromonospora isolated from Tomato.**—*Phytopathology*, 47, 7, pp. 429–432, 1 fig., 1957.

A species of *Micromonospora* was isolated at Ohio State University, Columbus, from one tomato plant remaining healthy among a number that had been inoculated with *Fusarium oxysporum* f. [*F. bulbigenum* var.] *lycopersici*. In plate culture the *M.* sp. inhibited *F. b.* var. *lycopersici* markedly, and 50 per cent. filtrate of the *M.* cultures added to agar inhibited growth of the pathogen thereon and intensified its pigmentation [cf. 34, p. 801]. Symptoms of *Fusarium* wilt were considerably reduced in tomato plants the roots of which were placed in a liquid culture of the *M.* sp. before planting in *F.* infected soil or inoculating them by dipping the roots in a liquid culture of the pathogen, as opposed to controls not so treated. After immersion of the roots in Knop's solution containing *M.* filtrate for four days prior to inoculation, the Wellman disease rating of tomato plants [19, p. 170] was reduced to 1–4, as compared to 6–9 for untreated controls. *M.* sp. alone induced no macroscopic symptoms on tomato plants; it was reisolated from four of 20 inoculated plants.

Kern (H.), Sanwal (B. D.), & Kluepfel (D.). **Über die Umwandlung von markiertem Glykokoll durch Fusarium lycopersici.** [On the conversion of labelled glycine by *Fusarium lycopersici*.]—*Experientia*, 13, 7, pp. 281–282, 1 fig., 1 graph, 1957. [English summary.]

In further studies at the Eidgenössischen Technischen Hochschule, Zürich, young, rapidly growing mycelium of *Fusarium* [*bulbigenum* var.] *lycopersici* [36, p. 736] converted into carbon dioxide about 2 per cent. of C^{14}-methylene-labelled glycine added to the culture medium at the rate of 1 mg. per gm. mycelial weight. In older mycelium the carbon dioxide was almost inactive. The protein hydrolysate contained labelled glycine, serine, valine, and leucine, with small amounts of aspartic and glutamic acids. Valine and leucine have not apparently been previously identified as metabolic products derived from glycine.

Gäumann (E.). **Fusaric acid as a wilt toxin.**—*Phytopathology*, 47, 6, pp. 342–357, 2 figs., 12 graphs, 1957.

The author in this paper from the Eidgenössischen Technischen Hochschule, Zürich, notes that lycomarasmin is not, as has been stated, an ageing product of *Fusarium* [*bulbigenum* var.] *lycopersici*, but can be found in the mycelium on the seventh day, when there is 10 mg. per l. in culture filtrates; he then discusses in the light of 88 references, many of which have been noticed in this *Review*, the chemistry and formation of fusaric acid, its range, and the symptoms which it induces [cf. 32, p. 269].

It seems probable that in the production of fusaric acid ethyl alcohol is also formed in tomato shoots and has a specific toxic effect and a part in the pathogenesis of tomato wilt.

Neither fusaric acid nor dehydrofusaric acid [34, p. 251] has as yet been demonstrated within the mycelium and the means of their biosynthesis are not yet precisely known. They reach a peak during the vegetative growth of the pathogen, diminish, and then increase again some ten days later.

It is suggested that certain conditions within the host enable the pathogen to form toxins; in the absence of these, resistance is maintained, but when toxin synthesis can take place, the host becomes parasitized.

Fusaric and dehydrofusaric acid have been found only in the Hypocreaceae. Both occur in *F. b.* var. *lycopersici*, *Gibberella fujikuroi*, and possibly the second is present as well as the first in *F. heterosporum*. Only fusaric acid occurs in *F.*

vasinfectum, *Nectria cinnabarina* and *F. orthoceras*. Apparently in each fungus the fusaric acid acts in concert with one or more other toxins. Fusaric acid exhibits a wide host range, the sensitivity of which to the toxin varies both quantitatively and qualitatively. Variations also occur within specific tissues of the hosts, and only certain tissues are injured.

The minimal dose of fusaric acid to cause symptom development in tomato shoots is around 150 mg. of toxin per kg. of fresh weight, the sublethal dose about 300. The toxicity of the fusaric acid molecule is largely dependent on its degree of dissociation, which in turn is correlated with the prevailing pH [cf. 32, p. 70]. The optimum pH occurs within the xylem of tomatoes, enabling fusaric acid to initiate permanent cell injury and thus facilitate the action of other toxic substances.

Naef-Roth (Stephi). **Über die parasitogenen und toxigenen Veränderungen der Atmungsintensität bei Tomaten.** [On the parasitogenic and toxigenic changes of respiratory intensity in Tomatoes.]—*Z. PflKrankh.*, 64, 7–10, pp. 421–426, 1 graph, 1957. [English summary.]

The author summarizes and discusses the results of studies (already noticed in this *Review*) on the changes in the respiration rate of tomatoes induced by infection with *Fusarium* [*bulbigenum* var.] *lycopersici* and the action of its toxins, fusaric acid and lycomarasmin [see below]. Reference is further made to the literature on several other diseases characterized by enhanced respiratory activity.

Paquin (R.) & Waygood (E. R.). **The effect of Fusarium toxins on the enzymic activity of Tomato hypocotyl mitochondria.**—*Canad. J. Bot.*, 35, 2, pp. 207–218, 4 graphs, 1957. [French summary.]

In studies in the Department of Botany, McGill University, Montreal, lycomarasmin and fusaric acid, produced by *Fusarium oxysporum* f. [*F. bulbigenum* var.] *lycopersici*, inhibited the succinoxidase and cytochrome oxidase activity of mitochondria from hypocotyls and cotyledons of tomato seedlings, at a concentration of 100^{-2} *M*. This inhibition was prevented by the addition of minute amounts of cytochrome *c*.

These results support the theory that the action of wilt toxins on the tomato plant is to affect host metabolism by the removal of cytochrome *c* from the active sites, thus disturbing an enzyme system rather than destroying the semipermeability of the plasma membranes.

Gäumann (E.) & Bachmann (Elisabeth). **Über den Einfluß des Lycomarasmins und seiner Schwermetallkomplexe auf die Wasserpermeabilität pflanzlicher Protoplasten.** [On the influence of lycomarasmin and its heavy metal complexes on the permeability of plant protoplasts to water.]—*Phytopath. Z.*, 29, 3, pp. 265–276, 5 graphs, 1957. [English summary.]

The studies referred to in the bibliography appended to the authors' recapitulation and discussion of the information assembled to date on the influence of lycomarasmin on the permeability of plant protoplasts to water in relation to tomato wilt (*Fusarium* [*bulbigenum*] var. *lycopersici*) have already been noticed from time to time in this *Review*. The hypothesis that the iron ions of the host transported by the toxin to the 'wrong' place [35, p. 556] exert a strong influence on the disturbance of the water economy of tomato shoots was confirmed by further experiments on *Rhoeo discolor* [36, p. 50]. The desensitization of tomato shoots after successive applications of lycomarasmin is considered to be partially explicable by the fact that the first dose of the toxin removes a large percentage of the chelatable iron ions, leaving only a few to be encountered by the second application.

Joshi (K. C.) & Saxena (M. P.). **A serious Tomato fruit rot from Ajmer and method of its control.**—*Sci. & Cult.*, 22, 12, pp. 682–683, 2 figs., 1957.

At the Botany Department, Government College, Ajmer, India, *Rhizoctonia* [*Corticium*] *solani* was found to be responsible for the fruit rot which destroyed an entire crop of tomatoes [cf. 33, p. 188] in the Beer village, Ajmer district, in 1956. Since the fungus is soil-borne it is recommended that the fruits be kept away from the soil surface.

Izrail'sky (V. P.) & Karpovskaya (Mme S. Kh). Внутренняя зараженность семян Томатов бактериальным раком как фактор распространения инфекций. [The internal infection of Tomato seeds with bacterial canker as a factor in the spread of the disease.]—Докл. Акад. сельскохоз. Наук Ленина. [*Rep. Lenin Acad. agric. Sci., Moscow*], 6, pp. 22–26, 1957.

As a result of numerous experiments in different districts in U.S.S.R. with tomato seeds from plants infected with bacterial canker (*Corynebacterium michiganense*) [35, p. 624], it has been concluded that the infection is only partially due to the internal infection of the seeds.

In the three years of experiments the disease occurred twice, infection ranging from 0·26 to 0·73 per cent.

Geraldson (C. M.). **Control of blossom-end rot of Tomatoes.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 309–317, 2 figs., 1957.

Most of this information on the control of blossom-end rot of tomatoes in Florida has already been noticed [35, p. 795].

Maynard (D. N.), Barham (W. S.), & McCombs (C. L.). **The effect of calcium nutrition of Tomatoes as related to the incidence and severity of blossom-end rot.**—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 318–322, 1957.

At North Carolina State College, Raleigh, results of experiments with sand cultures confirmed the relationship between calcium deficiency and tomato blossom-end rot. The occurrence of the characteristic cellular breakdown at the blossom end of the fruit is attributed either to reduced solute movement or to structural weakness in this area.

At a medium level of calcium (0·00275 M) in the nutrient solution the variety Doublerich was more resistant to blossom-end rot than STEP 158 and probably more than Rutgers. There were no significant differences between the calcium contents of fruit of different varieties but the content of normal fruit was significantly higher than that of fruit affected by blossom-end rot.

Report on forest research for the year ended March, 1956.—vii+72 pp., 1 fig., 7 graphs, London, H.M. Stationery Office, 1957.

In the forest pathology section (pp. 64–67) of this report [cf. 35, pp. 556, 643] T. R. Peace and J. S. Murray state that fructifications of *Rhizina inflata* appeared in abundance in groups of dying conifers [36, p. 220] in the autumn of 1955 and there appears to be some connexion between fire sites, *Rhizina*, and group-dying. It is recommended that fires be confined to a few, trenched sites. Severe defoliation associated with *Sclerophoma pithyophila* [cf. 35, p. 855] occurred in East Anglia.

No further infections of *Thuja plicata* by *Keithia* [*Didymascella*] *thujina* [36, p. 220] were found in isolated nurseries, and it is considered worth while to keep new, reasonably isolated nurseries unaffected by introducing *T. plicata* only as seed. Individual trees show resistance [36, p. 438]. Inoculations of numerous poplar clones in the possession of the Research Branch with bacterial canker

[*Pseudomonas syringae* f.sp. *populea*: cf. 32, p. 522] gave more consistent results than those obtained in the Netherlands [cf. 35, p. 560], and survival was very satisfactory in an area of natural infection. *Cryptostroma corticale* [cf. 35, p. 645] was found on a felled sycamore [*Acer pseudoplatanus*] pole in Somerset, much farther west than before. Dutch elm disease (*Ceratostomella ulmi*) was ascertained to have made very little advance since 1949 [cf. 29, p. 541, *et passim*].

Dealing with soil mycology (pp. 83–86), Ida Levisohn states that Scots pine [*Pinus sylvestris*] grown in pots of non-sterile heathland soil from Wareham treated with a bracken-heather compost had, after two years, a rich development of normal mycorrhiza formed by *Boletus bovinus* [36, p. 624], while those in sterilized, composted soil from the same area were not infected, though of similar height and vigour. On transfer to two separate pits containing Wareham soil the mycorrhizal trees grew well and produced long needles of good colour, mycorrhizal development continuing, whereas those that were originally non-mycorrhizal made poor growth, had chlorotic foliage, and developed only a few subnormal infections. Pits containing Wareham soil were used to test pine seedlings raised in a more fertile heathland soil from Surrey. The plants were supplied with abundant normal mycorrhizas formed by unidentified mycelia, and had also a very small proportion of associations of parasitic *Rhizoctonia sylvestris* [cf. 35, p. 839]. In the pits, growth was severely checked, the infections by *R. sylvestris*, originally innocuous, becoming deleterious under the new soil conditions. This result shows the danger of an indiscriminate use of mycorrhizal trees for planting; failure in forest plantings might be avoided by preliminary tests in pot-cultures or pits. In other experiments, the average shoot length of birch grown in Wareham soil with one-third of the usual amount of compost, was, after the first growing season, 3·61 in. for 35 controls not inoculated, and 4·85 in. for 36 plants in soil inoculated with *B. scaber*. Stimulation of Lawson cypress [*Cupressus lawsoniana*] seedlings was noted four months after inoculation. When birch seedlings were grown in sterilized Yorkshire moorland soil into which the mycelium of *B. scaber* had been introduced, stimulation was recorded before mycorrhizal contact had been established; the benefit must, therefore, have been due to the rhizosphere activity of the mycelium. The failure of the inoculum to stimulate the plants in the untreated soil indicates that *B. scaber* was already present, a conclusion agreeing with the observations made at Oxford that this species is a dominant mycorrhizal fungus in most moorland soils in Yorkshire. Among young cuttings from endotrophic species of trees, some samples of all species were recorded as mycorrhizal, i.e., species of *Sequoia*, *Metasequoia*, *Cryptomeria*, *Sciadopitys*, *Cupressus*, and *Platanus*. The presence or absence of mycorrhizal association and the degree of infection appear to depend mainly on the nature of the soil in which the cuttings are grown. In the ectotrophic series (*Abies*, *Picea*, *Tsuga*, and *Pinus* spp.), only a cutting from *Pinus radiata* showed mycorrhizal infection, which was of a sub-normal type. Forked short roots in a three-year-old cutting of *P. sylvestris* are attributed to some soil factor other than the presence of a mycorrhiza-former.

D. M. Griffin (pp. 86–87) states that in the assessment of root damage in plots of conifers in forest nurseries the mean percentage of dead root-tips, together with the mean percentage of dead tap-roots, is recorded for a random sample of 20 seedlings; this works well with Sitka spruce [*Picea sitchensis*], and provides an estimate of the maximum damage that could have been caused by fungi.

J. Rishbeth (pp. 87–88) states that a tour of various British forests showed that attacks on pine by *Fomes annosus* [36, p. 505] originated in the same way as in East Anglia but were seldom on such a large scale. The more widespread butt rot of larch and spruce, caused predominantly by *F. annosus*, was common and sometimes severe on sites that had formerly borne conifers, and occasionally early stages were detected on non-woodland sites after thinning. In no instance was it

necessary to assume a mode of infection other than by root contact with infected stumps. *F. annosus* is becoming established in many new plantations.

J. G. Manners (pp. 88–89) reports that when 48 potted larch trees were frost-damaged in a cold air-stream, 12 developed cankers within nine months, the proportion being higher among trees inoculated with *Trichoscyphella willkommii* [35, p. 557] than among the uninoculated, though no fungus fruit or mycelium had yet appeared.

P. Biggs (pp. 89–90) recognized eight distinct strains of *Meria laricis* among cultures from larch in Forestry Commission nurseries. Four of the strains, comprising most of the isolates, belong to group 'a', which corresponds in some cultural characters (though not all) to the 'a' of Peace and Holmes [13, p. 281]; the other four are placed in group 'b'.

R. G. Pawsey (p. 91) states that in attempts to obtain *Didymascella thujina* in artificial culture there was no development beyond the germ-tube stage of ascospore germination. The optimum temperature range for germination was 12° to 15° C. Discharge of ascospores occurred over a wide range of temperatures and a limited range of humidity and appeared to be continuous.

Schwerdtfeger (F.). **Die Waldkrankheiten. Ein Lehrbuch der Forstpathologie und des Forstschutzes.** [Forest diseases. A text-book of forest pathology and forest protection.]—485 pp., 144 figs., 53 graphs, 2 maps, Hamburg and Berlin, P. Parey, 1957. DM. 40.

This is the second, complete and revised edition of the author's text book on forest diseases [24, p. 255], of which there has been an intermediate abridged edition [30, p. 251]. This comprehensive work is now divided into seven sections, dealing respectively with the principles of forest pathology and protection; non-parasitic disorders; parasitic diseases; susceptibility and resistance; disease development and symptomatology; economics; and protection and control. There is a useful host and parasite index, indicating the part of the tree affected.

Stoeckeler (J. H.) & Jones (G. W.). **Forest nursery practice in the Lake States.**—*Agric. Handb. U.S. Dep. Agric.* 110, iv+124 pp., 45 figs., 14 diags., 5 graphs, 1957.

On pp. 88–93 of this handbook diseases commonly encountered in forest nurseries of Wisconsin, Minnesota, and Michigan are briefly described and control measures indicated. It is stated that in addition to the ferbam-sulphur treatment [33, p. 431] cedar-apple rust (*Gymnosporangium juniperi-virginianae*), attacking red-cedar [*Juniperus virginiana*] and other junipers [36, p. 192], can be controlled by Bordeaux 180 (12 lb. copper sulphate, 12 lb. hydrated lime, 2 lb. mono-calcium arsenate, and 8 lb. zinc arsenate per 100 gals. water) applied with a spreader in the spring, thus preventing the teleutospore development. Similarly, elgetol applications (1 gal. per 100 gals. water) give satisfactory control. In tests conducted by Forrest Strong of Michigan State University actidione (100 p.p.m.) was shown to be promising.

Vaartaja (O.). **The susceptibility of seedlings of various tree species to Phytophthora cactorum.**—*Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can.*, 13, 2, p. 2, 1957.

At the Forest Pathology Laboratory, Saskatoon, Saskatchewan, *Phytophthora cactorum* [35, p. 406] was shown to be potentially pathogenic to four species each of pine and spruce, two of larch, one of birch, and to elm. *Thuja plicata* and *Larix laricina* were less susceptible than the other species tested.

Berbee (J. G.). **Virus symptoms associated with Birch die-back.**—*Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can.*, 13, 1, p. 1, 1957.

In 1955 and 1956 selected yellow birches suffering from die-back [35, p. 796] in

New Brunswick and Nova Scotia were observed to have an atypical growth habit in which buds on the previous year's growth failed to develop. As the disease advanced the foliage became clumped at the ends of the branches and eventually witches' brooms were formed. A large number of adventitious shoots were produced on the main stem. Many parts of the tree including buds, catkins, leaves, and twigs all exhibited symptoms which appeared to be typical of virus infections.

In transmission experiments to test the possible virus nature of die-back healthy seedlings were grafted by roots or stems to diseased trees in the field. All became diseased in the same season that the grafts were made. When diseased scions were grafted to healthy stocks many of the stocks showed die-back symptoms in the second growing season. It is evident that an infectious agent has been transmitted from typical die-back trees to healthy seedlings and mature trees; it has yet to be seen if the symptoms transmitted can account for the recent widespread mortality of white and yellow birch in Eastern Canada and the North Eastern United States [loc. cit.].

Gäumann (E.) & Naef-Roth (S[tephi]). **Über die Toxine der Endothia parasitica (Murr.) And.** [On the toxins of *Endothia parasitica* (Murr.) And.]—*PflSchBer.*, 19, 1–9, pp. 9–16, 1957. [English summary.]

From the Eidgenössischen Technischen Hochschule, Zürich, the authors describe the isolation of two toxins, diaporthin and skyrin, from the medium and mycelium, respectively, of a 20-day culture of *Endothia parasitica* on Bazzigher's modified Knop's medium at 18° C. [33, p. 569]. The concentrations of the two toxins required to inhibit growth of three bacteria, or to produce 50 per cent. inhibition of germination or growth in five test fungi, was determined, and activity in higher plants was assessed by the 'wilt index' in 4-leaved tomato shoots which received various doses of toxin (125 to 500 mg. per kg. fresh weight).

It was found that *Micrococcus pyogenes* v. *aureus* [*Staphylococcus aureus*] and *Rhizoctonia* [*Corticium*] *solani* could be used to distinguish between the toxins, the former being inhibited by skyrin but not diaporthin, and the latter *vice versa*. Both toxins acted as stem poisons in tomato, evoking necrosis of the vascular bundles and a collapse of superficial tissues to form longitudinal grooves. Diaporthin also damaged the vascular strands in the leaf (as it does also in the chestnut), but with skyrin this effect has not yet been investigated.

Diaporthin is of unknown chemical structure (empirical formula C_{13} H_{14} O_5), while skyrin is a bianthraquinone of formula C_{30} H_{18} O_{10}. The former is known only in *Endothia*, but the latter is synthesized also by *Penicillium islandicum*.

Bazzigher (G.). **Tannin- und phenolspaltende Fermente dreier parasitischer Pilze.** [Tannin- and phenol-splitting enzymes of three parasitic fungi.]—*Phytopath. Z.*, 29, 3, pp. 299–304, 1 diag., 1 graph, 1957. [English summary.]

The author has already demonstrated the presence in *Endothia parasitica* of tannin- and phenol-splitting enzymes [35, p. 246]. In further studies along the same lines at the Federal Institute for Silvicultural Research, Zürich, Switzerland, he found that *Herpotrichia nigra* from pine needles [cf. 34, p. 328] and *Fomes annosus* from spruce also contain esterase and pyrogallase, which proved to be responsible for the breakdown of tannins, gallic acid, and various phenols. Within a temperature range of 0° to 70° C. the optimum for enzymatic activity probably lies round about 45°. Both were relatively stable in experiments with the usual enzyme-inhibitors, though glucose and hydroquinone inactivated pyrogallase.

The fact that esterase and pyrogallase are produced by *E. parasitica*, *H. nigra*, and *F. annosus in vivo* as well as *in vitro* would appear to exclude tannins, gallic acid, and phenols as factors in resistance to disease.

Zuckerman (B. M.). **Effects of X rays on the germination of conidia of the Oak wilt fungus.**—*Phytopathology*, 47, 6, pp. 361–364, 2 figs., 3 graphs, 1957.

At the Illinois State Natural History Survey, Urbana, spores of *Endoconidiophora fagacearum* [*Chalara quercina*] were exposed to X-rays at increasing dosages from 5 to 200 kiloroentgens (kr.) per minute. Dosages over 20 kr. rapidly inhibited secondary spore formation and delayed inception of germination. At 30 to 80 kr. many abortive germ-tubes formed, and at 50 to 110 kr. many spores formed knob-like projections and grew no further. Over 110 kr. almost total cessation of germination occurred.

Peace (T. R.). **Needle disease of conifers.**—*J. For. Comm.* 25, pp. 169–172, 1956.

Notes are given on the following needle diseases of conifers in Great Britain: on pine, *Lophodermium pinastri* [32, p. 108], *Sclerophoma pithyophila*, and *Coleosporium senecionis* [cf. 34, p. 346]; on spruce, *Chrysomyxa rhododendri*, *C. abietis* [32, p. 460], *Rhizosphaera kalkhoffii* [35, p. 556], and *Lophodermium macrosporum* [loc. cit.]; on larch, *Meria laricis* [36, p. 146]; on Douglas fir [*Pseudotsuga taxifolia*], *Rhabdocline pseudotsugae* [35, p. 556] and *Phaeocryptopus gaeumanni* [35, p. 129]; on *Thuja*, *Keithia* [*Didymascella*] *thujina*; and on silver fir [*Abies alba*], *Rehmiellopsis bohemica*. Except for *Didymascella* on *Thuja*, there is no needle disease which is a serious threat in Great Britain.

Volger (Christiane). **Über Bekämpfungsmöglichkeiten pilzparasitärer Keimlingskrankheiten unserer Nadelbäume.** [On the possibilities of combating seedling diseases of our conifers caused by parasitic fungi.]—*Allg. Forstz.*, 12, 8–9, pp. 114–116, 4 figs., 1957.

This is a report from the Institute for Silvicultural Technology, Hann.-Münden, on the existing situation in respect of conifer disease control in German nurseries by biological, mechanical, physical, and chemical methods. The most hopeful line of approach to the problem is considered to be prophylactic, consisting in simple measures to protect the seedlings from any delay in growth and from physiological weakening, e.g., reasonably shallow sowing at the correct date, an ample water supply to maintain turgor pressure, and adequate shading. There are stated to be about 30 [unspecified] fungi parasitic on conifer seedlings. In the author's tests with chemical disinfectants the most effective seed dressing was tripomol, a Dutch preparation based on thiram and supplied by Fabriek van Chemische Producten, Vondelingenplaat, the fungicidal action of which persisted for 11 weeks.

Zineb proved useful as a spray or dust but was ineffectual as a seed-protectant. Dusting with brassicol gave good results in a seed-bed experiment on Douglas fir [*Pseudotsuga taxifolia*].

Iversen (A.). **Om jordvandets bevægelser og dets evt. betydning som smittevej for rodfordærveren Fomes annosus.** [On the movements of soil water and its possible significance as a channel of infection for root rot, *Fomes annosus*.]—*Dansk Skovforen. Tidsskr.*, 40, 9, pp. 432–437, 1955.

This is a theoretical discussion, based on the principles of electrostatics and hydrodynamics, of the possibility that soil water may play an important part, comparable to that of air, in the dissemination of *Fomes annosus*, the agent of root rot of conifers in Denmark [35, p. 565].

Smerlis (E.). **Hylobius injuries as infection courts of root and butt rots in immature Balsam Fir stands.**—*Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can.*, 13, 2, p. 1, 1957.

In a study of immature balsam fir [*Abies balsamea*] in Laurentide Park, Quebec,

33 different fungi were isolated from decays of roots, root collars, and butts which were linked with injury from larvae of *Hylobius* sp. One wood-destroying fungus, *Stereum sanguinolentum* [36, p. 69], was identified.

BASHAM (J. T.). **The deterioration by fungi of Jack, Red, and White Pine killed by fire in Ontario.**—*Canad. J. Bot.*, 35, 2, pp. 155–172, 3 pl., 6 graphs, 1 map, 1957.

The fungi associated with decay of jack, red, and white pines [*Pinus banksiana*, *P. resinosa*, and *P. strobus*] killed by fire in the Mississagi region of Ontario in 1948 were investigated until 1953 with relation to the value of salvage. In the first year after the fire blue and brown sapwood stains appeared, followed by sap rot after two years, until after five years most of the heartwood was affected. White sap rots were chiefly caused by *Peniophora gigantea* [36, p. 740], *Polyporus anceps* [cf. 34, p. 498] (from 1951 onwards), and *P.* [*Polystictus*] *abietinus* [34, p. 799], while brown sap rots were mostly associated with *Fomes pinicola* [36, p. 291], but *F. subroseus* [36, p. 437] (largely replacing *F. pinicola* after the first two years), *Lenzites saepiaria*, *Coniophora puteana* [36, p. 70], and *Poria monticola* [35, p. 132] were also commonly associated. Heart rot was due mainly to *Fomes pini* [36, p. 435] and was markedly greater in fire-killed trees than in living pines observed over the same period. The rate of deterioration was unrelated to the degree of severity of burn, but was faster in quicker growing trees (with more widely spaced outer annual rings).

PARKER (A. K.). **Europhium, a new genus of the Ascomycetes with a Leptographium imperfect state.**—*Canad. J. Bot.*, 35, 2, pp. 173–179, 1 pl., 1957.

At the Forest Biology Laboratory, Victoria, British Columbia, perithecia were found on the trunks of dead or dying western white pine (*Pinus monticola*) attacked by pole blight associated with *Leptographium* sp. [33, p. 456]. The perithecia are considered to represent the perfect state of the pole blight fungus, and to belong to a new genus of the Eurotiaceae. The fungus is named *Europhium trinacriforme* n.sp. and has perithecia 260 (225 to 345) μ in diameter; globose to sub-globose asci 5 to 9 μ in diameter; and hyaline, unicellular ascospores with a tricorn envelope, cucullate in side view, 4·8 (3·6 to 5·4) by 2·2 (1·8 to 3·1) μ. Perithecia were produced in culture when isolates of *Leptographium* were paired on pieces of autoclaved pine sapwood and kept at room temperature for three to five weeks.

VAARTAJA (O.). **Damping-off control by antibiotic plant substances.**—*Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can.*, 13, 2, p. 2, 1957.

At the Forest Pathology Laboratory, Saskatoon, Saskatchewan, the use of natural plant substances in the control of *Rhizoctonia* [*Corticium*] *solani* was tested on jack pine (*Pinus banksiana*) seedlings in glass jars [35, p. 407]. Maize meal agar cultures of the pathogen were covered with a mixture of vermiculite and various powdered materials of plant origin in which the seeds were sown. Marked antibiotic activity was shown by leaves and bark of some common forest trees and by the lichen *Cladonia alpestre*. The protection lasted for longer than that given by orthocide 75. These results may have practical application.

LEVISOHN (IDA). **Differential effects of root-infecting mycelia on young trees in different environments.**—*Emp. For. Rev.*, 36, 3, pp. 281–286, 3 figs., 1957.

Much of this information has already been noticed [36, p. 794]. In pot and pit experiments at Bedford College, University of London, inoculation with *Amanita muscaria* improved the growth of Norway spruce (*Picea abies*) in soil from some parts of Wareham Heath, Dorset, but not in that from other parts; similar results were obtained with birch and *Boletus scaber*. In particularly poor soil from the area both trees benefited from mycorrhizal association with *B. scaber* but not with *A.*

muscaria. In soil from Yorkshire the development of birch seedlings was definitely retarded by *B. scaber*.

Peace (T. R.). **Recent observations on the rusts of Pine in Britain.**—5 pp., London, Forestry Commission, 1957.

Notes are given on the present phytopathological status of the five species of rust occurring on *Pinus* in Great Britain. The widespread occurrence of *Ribes* spp. make it almost impossible to find planting sites for Weymouth pine (*Pinus strobus*) at least a mile from any source of infection by *Cronartium ribicola* [30, p. 203]. At present the best prospects of control are by planting *P. strobus* in mixed stands and by the increasing use of *P. peuce*, which so far appears to be unaffected. *C. flaccidum*, *Peridermium pini*, and *Coleosporium tussilaginis* are of negligible economic importance. The only species severely affected by *Melampsora pinitorqua* [30, p. 552] is *Pinus sylvestris*, and the disease has not been recorded north of Yorkshire. In a survey in Kent in 1946 it was shown that the spores were unable to travel further than 300 yds. from aspen, the alternate host, but it is not considered advisable to plant Scots pine in the neighbourhood of aspen in southern England.

Bolland (G.). **Resistenzuntersuchungen vor allem über Kienzopf und Schütte an der Kiefer.** [Studies on resistance with particular regard to bark blister rust and needle cast of the Pine.]—*Züchter*, 27, 1, pp. 38–47, 5 figs., 1957. [78 refs.]

Following a general discussion of the objectives of selective breeding in forestry the author outlines the position regarding bark blister rust (*Peridermium pini*) and needle cast (*Lophodermium pinastri*) of pine, and describes his work on these diseases at the Waldsieversdorf plant-breeding substation of the Institut für Forstwissenschaften, Eberswalde, Deutsche Akademie der Landwirtschaftswissenschaften, Berlin.

Seedlings and young trees, the progeny by natural pollination of known adult trees, were inoculated with *P. pini* on the needles and one- to three-year-old shoots, as were the trunks of older trees. Infection, as evidenced by the formation of aecidia, occurred only where spores were introduced into small wounds in the May–June shoots of the current year, irrespective of the age of the tree. Aecidial formation occurred in the first year once only. In the second year 53 out of 299 (17 per cent.) showed infection, and more are expected to do so in the coming year. Investigations are under way to determine to what extent the susceptibility of the progeny reflects that of the parent tree, and whether the factor for resistance is dominant.

Young trees have a certain resistance to *P. pini* so that those which become infected after inoculation may be singled out as being particularly susceptible.

Tests for resistance to *L. pinastri* were carried out with similar seedlings and young trees. Infection was achieved by strewing infected needles round the plants, and susceptibility graded on a scale running from 0–5 (0 signifying no lesions present, and 5 that the entire surface of the needles was brown). The first year favoured the fungus, and there was 99·7 per cent. mortality, but in the tests in the following year there was much less infection and individual differences in susceptibility were clearly seen. Results so far indicate that the distribution of susceptibility among the progeny of a single tree remains much the same from year to year. It is emphasized that not one immune seedling was found, but that the ability to recover from infection varied considerably. Nothing can yet be said about the inheritance of resistance to this disease.

Murray (J. S.). **Top dying of Norway Spruce in Great Britain.**—8 pp., London, Forestry Commission, 1957.

Top dying of Norway spruce (*Picea abies*) appears to be caused by attacks by

a number of insects and fungi, of which *Rhizosphaera kalkhoffii* [36, p. 797] is the most important, following weakening of the tree by drought. It is widespread and probably as serious as decay caused by *Fomes annosus*. The species should not be planted in areas where drought is likely to occur, and drastic thinning or exposure should be avoided.

Nordin (V. J.) & Carmichael (E. J.). **Red stain in Lodgepole Pine.** —*Bi-m. Progr. Rep. Div. For. Biol., Dep. Agric. Can.*, 13, 1, p. 3, 1957.

This information on the fungi associated with red stain in lodgepole pine [*Pinus contorta* var. *latifolia*], mainly *Stereum pini*, has already been noticed [35, p. 854].

Trione (E. J.) & Roth (L. F.). **Aerial infection of Chamaecyparis by Phytophthora lateralis.**—*Plant Dis. Reptr*, 41, 3, pp. 211–215, 4 figs., 1957.

This is an expanded version of a paper already noticed [36, p. 505]. Sporangia of *Phytophthora lateralis* rarely develop on infected leaves of *Chamaecyparis lawsoniana* unless free water is present. Since they are apparently transported in water droplets, driving winter rains and hard winds are important in the spread of the disease.

Scurti (J. C.). **Sulla demolizione della cellulosa e della lignina per opera dei funghi lignicoli.** [On the destruction of cellulose and lignin through the agency of lignicolous fungi.]—*Nuovo G. bot. ital.*, N.S., 63, 2–3, pp. 411–412, 1956.

In work at the Experimental Laboratory of Phytopathology, Turin, Italy, *Armillaria mellea* from elm, *Collybia velutipes* from magnolia, *Schizophyllum commune* from poplar, and a basidiomycete thought probably to be a species of *Fomes*, obtained from the discoloured wood of a peach tree affected by silver-leaf disease [cause unspecified: cf. 34, p. 462], were able to utilize *in vitro* two sources of cellulose and two of lignin [cf. 10, p. 700; 18, p. 360; 30, p. 296].

Lohwag (K.). **Über die Abbauintensität des Polyporus betulinus (Bull.) Fr.** [On the intensity of decomposition by *Polyporus betulinus* (Bull.) Fr.]—*Sydowia*, Ser. II, *Beih.* 1, pp. 183–186, 1957. [English summary.]

In further experiments at the Institute for Soil Culture, Vienna, using the standard German wood-block method (DIN-leaflet 52176), *Polyporus betulinus* [35, p. 857] caused the following average losses of weight over a four-month period: *Acer platanoides* 10 per cent.; birch (*Betula pendula*) 8; hornbeam 30; beech 17; poplar (*Populus alba*) 18; oak (*Quercus sessiflora*) heartwood 0·4; *Abies alba* 22; spruce 11; and pine (*Pinus sylvestris*) sap and heartwood 13 and 1·5, respectively.

Lohwag (K.). **Moderfäule.** [Soft rot.]—*PflSchBer.*, 19, 1–9, pp. 17–20, 1 fig., 1957. [English summary.]

At the Institute for Agricultural Plant Protection and Forest Pathology, the College of Soil Culture, Vienna, four *Chaetomium* species and *Trichurus terrophilus* were examined for their activity against beech, spruce, and Scots pine by the normal malt-peptone-agar block technique [36, p. 506] over a period of four months. Special watch was kept for the formation of rhomboid cavities within the secondary cell walls [34, p. 562; 35, p. 563], a process characteristic of soft rot. This was most clearly seen in beech with *C. globosum* which had caused 20 per cent. decomposition. The cavities are not clearly to be seen where the process has gone too far, or not far enough. In a second series of similar tests three deciduous and three coniferous wood samples were exposed for six months to *C. funicolum*, which had proved particularly active against beech.

It was concluded that soft rot is caused by ascomycetes and fungi imperfecti, deciduous wood being more susceptible than coniferous. The process occurs

particularly at damp surfaces and can be observed not only in cooling towers [loc. cit.] but in situations where woodwork is in contact with damp soil or masonry. No losses of economic importance have yet been recorded in Austria.

Becker (H.). **Moderne Verfahren zur Konservierung von Holz und Holzbauten.** [Modern procedures for the preservation of wood and wooden structures.]—*Seifen-Öle*, 82, 10, pp. 280–281, 1956.

The advantages and drawbacks and the principal uses of (I) water-soluble, (II) oily, and (III) oil and salt mixtures in up-to-date timber preservation are concisely outlined [cf. 35, p. 735].

Yearsley (M. G.). **Final report on trials of copper naphthenates and mercuric naphthenates as wood preservatives.**—*Emp. For. Rev.*, 36, 3, pp. 287–291, 1957.

From the final observations on graveyard tests in Trinidad [25, p. 378] it is concluded that copper and mercuric naphthenates are efficient timber preservatives; a 20 per cent. solution of copper naphthenate in gas oil rendered white pine [*Pinus strobus*] resistant to termites and fungal attack for over 16 years. Gas oil alone preserved white pine for seven years but cannot be considered satisfactory.

New vegetable varieties. List IV.—*Proc. Amer. Soc. hort. Sci.*, 69, pp. 574–587, 1957.

Among the newer varieties (released in 1957) in this fourth list [cf. 36, p. 153] are the beans [*Phaseolus vulgaris*] Corneli 14, Earligreen, Pearlgreen, Tenderwhite, Wadex, and Red Shellout, resistant to bean common mosaic virus [36, p. 80]. Resistance to mildew [? *Peronospora parasitica*] is claimed for the cabbage Eastern Ballhead and the pea Emerald possesses slight resistance to *Fusarium* [*oxysporum* f. *pisi*]. The tomato Vinequeen is resistant to all known races of *Cladosporium fulvum* [35, p. 649].

Martini (C.). **Versuche zur Reinigung und Herstellung der Antiseren von Blumenkohlmosaik (Cauliflower mosaic virus) and Schwarzringfleckigkeit des Kohles (Cabbage black ring spot virus).** [Experiments on the purification and preparation of the antisera of Cauliflower mosaic virus and Cabbage black ring spot virus.]—*Naturwissenschaften*, 44, 15, pp. 426–427, 1957.

Negative results were given by attempts at the Institut für Pflanzenkrankheiten, University of Bonn, to secure an antiserum for cauliflower mosaic virus by ultracentrifugation [cf. 30, p. 297] after the 6th, 9th, and 12th intravenous injection into rabbits (at 5-day intervals) of a purified preparation from Chinese cabbage. After the 3rd injection, however, a specific reaction appeared to develop when the serum was diluted 1:1 and the antigen 1:1–1:4. The shape of the precipitate recalled that of lucerne mosaic virus, which is reputed to be the smallest known plant virus with its spherical particles of 16·5 mμ diam. [20, p. 472].

An effective antiserum (titre 512), which did not require to be freed from antibodies against normal plant proteins was obtained after the 3rd injection from cabbage black ring spot virus prepared by the same method.

Popov (V. I.). Сортовая устойчивость белокончанной Капусты к сосудистому бактериозу. [Varietal resistance of white Cabbage to vascular bacteriosis.]—Докл. Акад. сельскохоз. Наук Ленина. [*Rep. Lenin Acad. agric. Sci.* = *Proc. Lenin Acad. agric. Sci.*], 22, 5, pp. 26–29, 2 figs., 1957.

The microscopic study in the U.S.S.R. of the roots of cabbage plants susceptible and resistant to vascular bacteriosis (*Xanthomonas campestris*) [35, p. 255] showed that the proportion of mechanical to parenchymal tissue is of great importance, the mechanical predominating in resistant plants.

Ruizhkova's theory that potassium deficiency increases susceptibility [34, p. 763] was confirmed in experiments with fertilizers. Fifty days after sowing, plants with potassium deficiency had no mechanical tissues in the roots or stems.

Resistance of the Likurishka variety in the field was very high, infection amounting to only 0·01 per cent.

Andrén (F.). **Bekämpningsförsök mot klumprotsjuka.** [An experiment in the control of club root disease.]—*Växtskyddsnotiser, Stockh.*, 21, 2, pp. 34–35, 2 figs., 1957.

Excellent control of club root (*Plasmodiophora brassicae*) on Brussels sprouts is reported from Färentuna, Sweden, where 25 kg. brassisan was strewn over an area of about 400 sq. m. and worked into the soil before planting [cf. 34, p. 565]. The plants in the treated plot gave a practically normal yield and the roots were almost free from swellings, whereas those in the remainder of the field were rotting lumps.

Barton (R.). **Germination of oospores of Pythium mamillatum in response to exudates from living seedlings.**—*Nature, Lond.*, 180, 4586, pp. 613–614, 1957.

At the Department of Cryptogamic Botany, University of Manchester, oospores of *Pythium mamillatum* on glass fibre tapes [31, p. 394] were stained in phenolic rose bengal and buried for 3 days in garden soil beneath 2 to 5-day-old turnip seedlings. Germination by germ-tube formation occurred in scattered areas on each tape, suggesting stimulation in proximity to the roots. Oospores in soil without seedlings did not germinate. Oospores were stimulated by germinating turnip seeds in distilled water in Petri dishes, even when the seedlings and tapes were separated by filter-paper. When turnip seedlings were grown for 7 days in water the exudate solution, concentrated by freeze-drying, was shown to increase germination.

Reitberger (A. Lois). **Ruhekernuntersuchungen bei gesunden und viruskranken Diploiden und Polyploiden von Beta vulgaris.** [Studies of the resting nucleus in healthy and virus-infected diploids and polyploids of *Beta vulgaris*.]—*Züchter*, 26, 4–5, pp. 106–117, 26 figs., 1956.

At the Rosenhof substation of the Max Planck Institut für Züchtungsforschung, Ladenburg am Neckar, the resting nuclei of beet leaf epidermal cells in the pale green flecks resulting from mosaic virus infection were found to exhibit marked changes, while those in the surrounding green tissue were normal. Stages could be made out in the changes occurring in the 'mosaic' nuclei; the nucleolus enlarges and there appears within it a vacuole which migrates to the 'boundary', which after stretching allows it to pass out. Once outside, the vacuole enlarges considerably and the nucleolus is distorted to make room for it. In older leaves the vacuole, once out of the nucleolus, may develop a 'capsule' of greater or lesser thickness, staining variously but never as strongly as the nucleolus.

Sommer (E.). **Untersuchungen des Stoffwechsels vergilbungskranker Rüben unter mitteldeutschen Verhältnissen.** [Studies on the metabolism of yellows-diseased Beets under central German conditions.]—*Z. Zuckerind.*, N.S., 7, 8, pp. 387–393, 11 graphs, 1957. [English and French summaries.]

The studies herein reported from the Institut für Pflanzenzüchtung, Kleinwanzleben, were initiated at the end of June, 1954, when beet yellows virus was rife in central Germany. The following were among the metabolic changes induced by the disease [36, p. 227]. Reducing sugars increased to a marked extent in the leaf veins, while a similar trend was observed in respect of the ash and 'noxious' nitrogen contents. A decrease in the activity of the acid phosphatase [cf. next abstract] was already noticeable a few days after the occurrence of infection.

HENKE (O.). **Untersuchungen über einige am KH-Stoffwechsel und KH-Transport beteiligte Fermente in vergilbungskranken Zuckerrübenblättern.** [Studies on some enzymes participating in the CH-metabolism and CH-transport in yellows-diseased Sugar Beet leaves.]—*Phytopath. Z.*, 29, 4, pp. 469–480, 2 figs., 1957.

Saccharase activity in the laminae of yellows virus-diseased sugar beet leaves examined at the Institut für Phytopathologie, Naumburg (Saale), Germany, was found to be appreciably higher than in comparable healthy material, whereas in the petioles it was lower. Quantitative phosphatase determinations revealed a more or less heavy reduction of activity in the midribs and especially in the petioles [cf. preceding abstract], accompanied by a marked increase in the leaf blades.

The paper concludes with a discussion of the significance of these changes in relation to CH-transport and their possible connexion with the accumulation of assimilates in infected foliage.

TUPENEVICH (S. M.). Использование качественных различий семян столовой Свёклы в борьбе с корнеедом всходов. [Using the quality differences of table Beet seeds in the control of black leg in seedlings.]—*Trud. vsesoyuz. Inst. Zashch. Rast.*, 5, pp. 131–138, 2 figs., 1954. [Received 1957.]

In field trials in the U.S.S.R. the table beet seedlings developing from seed from the main, central inflorescence were more resistant to black leg [*Phoma betae*: 35, p. 501] than the weaker ones from seed from the side inflorescences and root yields of the former were 9 to 12 per cent. higher in 1951 and 8 to 20 per cent. in 1952.

WENZL (H.) & KREXNER (R.). **Untersuchungen über die Wirkung der Saatgutbeizung bei Rübe.** [Studies on the effect of seed treatment in Beet.]—*PflSchBer.*, 18, 8–12, pp. 119–170, 14 graphs, 1 fig., 1957. [English summary.]

From the Federal Centre for Plant Protection, Vienna, the authors report an important series of trials carried out from 1952 to 1955 to investigate the effect of seed treatments on black leg and die-back of sugar and fodder beet due to a number of pathogens. The literature is reviewed, and there is an extensive bibliography. The numerous fungicides used [cf. 36, p. 156] fell into eight groups. Most of them contained mercury or mercury and copper, in some instances combined with lindane or dieldrin. They were tested under varied conditions, and at three levels of sowing (30, 20, and 15 kg. of seed per ha.). Some of the trials were to determine the effectiveness of seed treatments against *Cercospora beticola* infection.

In the main experiments notable results were achieved only where early-sown seed encountered conditions causing crust development at the soil surface or otherwise discouraging growth. Organic mercury-lindane preparations proved the best, exhibiting combined activity against black leg, wireworm, and *Cercospora* infection of the seed; treated seed sown at a rate of 21 kg. per ha. gave better results than untreated seed at 30 kg. per ha. 'Legginess' (branching of the roots) was little affected by seed treatment. Estimation of failure in the young stands immediately prior to thinning gave a reliable and ready measure of the effects of the fungicides: in a sample row all gaps exceeding 25 cm. were measured and totalled and 10 m. per 100 m. in an untreated crop was taken to indicate that seed treatment should have been carried out.

Mercury preparations gave good results for seed heavily infected with *C. beticola*, though these were not as clear as those of Koch and Knapp [33, p. 516; 34, p. 15].

GRAF (A.) & WENZL (H.). **Zur Frage der Bekämpfung des echten Rübenmehltaues.** [Concerning the control of true Beet mildew.]—*PflSchBer.*, 18, 6–7, pp. 81–89, 1 graph, 1957. [English summary.]

The author reports spray trials in Austria with copper oxychloride against

powdery mildew (*Erysiphe communis* [*E. polygoni*]) on five varieties of sugar beet [cf. 35, p. 146]. At harvest untreated controls exhibited heavy infection of the older foliage and usually of the younger foliage also. The spray was applied at the rate of 1·7 kg. of copper (as copper oxychloride) in 400 l. of spray per ha., on the 17th July, 8th August, and in some cases the 28th August. Three treatments suppressed infection entirely on all the varieties, and two reduced it to a minimal level.

The average yields of sugar, foliage, and roots from treated and untreated plots were 63·9, 284·4, and 336·4 quintals per ha., respectively. The respective yields for the different treatments, expressed as percentages of these experimental means, were as follows:—controls 89·2, 89·0, and 90·3; twice treated plots 100·3, 103·8, and 99·8; and thrice-treated plots 110·5, 107·2, and 109·9. Since infection was negligible on all the treated plots, the increased yields resulting from the third treatment were most probably attributable to a trace element effect.

Schneider (C. L.). **Studies on the pathogenicity and host range of the Sugar Beet black root fungus, Aphanomyces cochlioides Drechs.**—Abs. in *Diss. Abstr.*, 17, 4, p. 735, 1957.

In greenhouse inoculations of sugar beets with *Aphanomyces cochliobolus* at the University of Minnesota zoospores were found to be the most suitable type of inoculum [cf. 35, p. 142]. Of the 94 plant species, representing 31 families, inoculated in the laboratory and greenhouse, 30 included in the following families became infected: Aizoaceae, Amaranthaceae, Chenopodiaceae, Hydrophyllaceae, Papaveraceae, Portulacaceae, and Solanaceae. The fungus was isolated from 18 of these 30 species when grown in naturally infested soil. *Chenopodium album*, *Amaranthus blitoides*, *Salsola kali*, and *Saponaria officinalis* became infected in the seedling stage and when the plants were a fortnight old and *Lychnis alba* and *Portulaca oleracea* in the seedling stage only.

Greenhouse and field tests showed that none of the garden beets, mangels, and chard varieties was immune or more resistant than sugar beet varieties developed for black root resistance.

Minor differences on the respective hosts were observed among some 40 single-spore isolates, from Michigan, Minnesota, Montana, and Ohio, which were studied in relation to physiologic specialization.

Brandenburg (E.). **Frühsymptome des Bormangels an Beta-Rüben.** [Early symptoms of boron deficiency on *Beta* Beets.]—*Z. PflKrankh.*, 64, 7–10, pp. 440–442, 5 figs., 1957. [English summary.]

Under natural field conditions in Germany the acute (heart-rot) phase of boron deficiency in beets [34, p. 575] is often preceded by symptoms indicative of a mild shortage. The middle and older leaves tend to be abnormally crinkled, with minute fissures on the lamina, extending from the upper epidermis to the palisade and spongy tissue. The cracks may either be in close proximity, covering large areas of the leaf blade, or localized in certain portions which frequently become lacerated. In the initial stages the foregoing symptoms somewhat resemble those caused by wind, while the later ones may be confused with the damage inflicted by hail-stones.

Wenzl (H.). **Blattdeformationen bei Zuckerrübe (Beta vulgaris).** [Leaf deformations in the Sugar Beet (*Beta vulgaris*).]—*PflSchBer.*, 18, 3–5, pp. 34–38, 4 figs., 1957. [English summary.]

At Grossweikersdorf, Lower Austria, in September, 1954, scattered plants with malformed leaves were seen in two otherwise normal fields of sugar beet on alluvial soil. In those affected, often with normal outer leaves, the intermediate leaves exhibited a terminal crinkling and reduction of the lamina and downward curling

of the edges. The innermost leaves were dwarfed, with a marginal brown necrosis. The calcium status of the soil was high, and there were no symptoms of boron deficiency. Roots from severely affected plants were more prone to storage rot, but roots from diseased plants produced normal plants in the following year and the cause of the condition, though still unknown, is not apparently a virus.

Smith (F. H.) & McWhorter (F. P.). **Anatomical effects of Tomato ringspot virus in Vicia faba.**—*Amer. J. Bot.*, 44, 6, pp. 470–477, 13 figs., 1957.

At the Department of Botany and Plant Pathology, Oregon State College, Corvallis, an isolate of tomato ring spot virus from cucumber was inoculated into the first or second foliage leaves of broad bean seedlings and a histological examination made of the course of infection. Necrosis spread from the epidermis to the larger veins of the leaf through the mesophyll, then rapidly followed the vascular system down the stem, at first affecting the parenchyma external to the phloem, or the immature primary phloem, then spreading laterally through the pith and cortex and invading the vascular tissue last. As the symptoms spread downwards into the root necrotic cells appeared independently in the lower root and root tips. Mitosis was inhibited and the susceptibility of the roots to soil fungi increased. Compact, alveolar inclusion bodies developed in the cells were similar to those of tobacco ring spot virus [12, p. 473].

Johnson (J. C.). **Pod twist: a previously unrecorded bacterial disease of French Bean (Phaseolus vulgaris L.).**—*Qd J. agric. Sci.*, 13, 3, pp. 127–158, 14 figs., 1956.

A new bacterial disease causing blight and twisting of the pods of French beans is recorded in Queensland. In its biochemical reactions the bacterium, for which the name *Pseudomonas flectens* sp. nov. is proposed, is similar to *P.* [*medicaginis* f.sp.] *phaseolicola* [35, p. 742] and *P. syringae* [33, p. 210] but it causes no definite pod spotting in the field and no leaf, stem, or systemic infection. The only apparent means of transmission in the field is by the bean thrips (*Taeniothrips nigricornis*). Pod twist was also observed on *Phaseolus lathyroides* growing near an infected bean crop; isolates from the two hosts were pathogenic when cross-inoculated by needle puncture in the greenhouse. Symptoms were later found to be general on *P. lathyroides*, the flowers of which were commonly infested by *T. nigricornis*.

Annual Report of the Agricultural Experiment Stations, Florida, for the year ending June 30, 1955.—356 pp., 38 figs., 8 graphs, [? 1956].

Some of the phytopathological information in this report [cf. 35, p. 510] has been noticed already. In the Plant Pathology Section (pp. 131–136) W. B. Tisdale states that methyl bromide (1 lb./50 sq. ft.) was again the most effective chemical tested against damping-off [unspecified] in celery seed-beds [36, p. 631]. Favourable results were also given by emulsifiable CBP (as a drench at 120 gal. per acre in 9,000 gal. water), and a mixture of 100 gal. formalin, 25 gal. allyl alcohol, and 20 gal. DD per acre in 9,000 gal. water.

C. W. Anderson obtained experimental evidence of the aphid transmission of both cowpea viruses known in Florida [cf. 35, p. 263]. The Sanford [chilli] pepper virus was ascertained to be unrelated to *Hyoscyamus* virus 3 [henbane mosaic virus: 24, p. 72], not identical with the [chilli] pepper veinbanding virus [35, p. 574] or [chilli] mosaic virus of Central and South America and Trinidad [34, p. 278], and probably more closely related to potato virus Y than to any other virus previously described.

According to J. R. Large, drought checked scab (*Cladosporium effusum*) and other foliage diseases of pecan in northern Florida in 1954, and induced phytotoxicity

from Bordeaux sprays. The only trees that preserved a healthy, dark green foliage at the end of the season were those sprayed with zineb (dithane Z-78) plus ¼ per cent. oil, or zineb plus organic mercury compounds. Mixing organic mercury compounds, tag 331, or emmi [35, p. 17] with captan 50 W or glyodin seemed to increase the effectiveness of these chemicals by about 8 per cent. Details are given of a number of formulations that gave 99–100 per cent. control [cf. 36, p. 504].

H. N. Miller notes the increasing importance of bacterial leaf-rot of certain species of *Philodendron* [cf. 35, p. 766] and the causal organism, apparently a species of *Erwinia*, is being extensively investigated. A species of *Alternaria* was consistently associated with a disease of *Schefflera* characterized by large, irregular brown blotches on the leaves and premature defoliation.

Lupins showed various symptoms of virus infection [cf. 33, p. 232], for most of which a single virus, tentatively designated lupin virus No. 1 [36, p. 809], appeared to be responsible. This induces three distinct diseases in *Lupinus angustifolius*, *L. luteus*, and *L. albus*. *L. angustifolius* displays also another symptom expression, caused by a virus tentatively designated lupin virus No. 2 [loc. cit.]. Both are transmitted mechanically and by *Myzus persicae* and *Aphis medicaginis*. Lupin virus No. 1 has a dilution tolerance of 1:1,000 but not 1:10,000, and is inactivated by heat at 60° C. for 10 min. The host range of both viruses was ascertained experimentally to be confined to the Leguminosae. Several native weeds and cultivated plants proved susceptible, and Lupin virus No. 1 was obtained from naturally infected *Melilotus indica*.

In the Experiment Station Reports J. F. Darby notes from Central Florida (pp. 162–167) that the addition of one or more of the following to allyl alcohol for the control of damping-off and [unspecified] root rots of vegetables compared favourably with methyl bromide: DD, EDB, OS-1897 (nemagon), and formalin. A mixture of 25 gal. of allyl alcohol, 20 gal. of DD, and 100 gal. of formalin per acre applied as a drench with approx. ⅓ acre-in. of water was outstanding.

J. W. Wilson tested 14 fungicides or combination of fungicides against downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) and powdery mildew (*Erysiphe cichoracearum*) on cantaloupe melons, which pathogens developed, respectively, slightly and severely. A mixture of the wettable powders of zineb (2 lb./100 gal.) and karathane (0·5 lb.) in each of 18 applications was as effective as a tank mix of zineb (2 lb.) to which 1 lb. of karathane was added in the last six applications after powdery mildew appeared. Maneb and nabam-manganese sulphate gave better control of powdery mildew than did zineb or nabam zinc-sulphate, and other formulations are listed.

In preliminary tests by J. F. Darby, PCNB incorporated into the soil before transplanting at 5, 10, and 15 lb. (active)/acre failed to reduce the incidence of sclerotiniose [? *Sclerotinia sclerotiorum* and *S. minor*: cf. 33, p. 232] of lettuce, while captan at 20 lb. per acre significantly increased it. A single application of aaventa (0·1 lb./100 gal.), an organic mercury compound, actidione (8 p.p.m.), and actidione (2 p.p.m.) plus dichlone (1 lb.) to lettuces and the surrounding soil as a drench at 500 gal. per acre after infection had become severe also failed to reduce the disease. The addition of 1 per cent. glycerine to 200 p.p.m. streptomycin sulphate STS reduced the incidence of bacterial spot (*Xanthomonas vesicatoria*) [cf. 35, p. 700] of [chilli] pepper below that given by streptomycin sulphate (agri-strep) alone.

From the Citrus Experiment Station L. C. Knorr and W. C. Price state (pp. 212–215) that citrus tristeza virus [cf. 36, p. 585] was probably brought to Florida, though not necessarily for the first time, in 1908 with the introduction of Meyer lemons from China [cf. 35, p. 764; 36, p. 99]. Budwood from 19 collections of Meyer lemon produced vein-clearing on Key lime in each case. *Citrus hystrix* showed

promise as an alternative indicator plant [36, p. 317]. A study of declining kumquat trees indicated that there may be another symptom complex of tristeza virus. Intense vein-clearing is caused in Key lime indicator plants when grafted with budwood from declining kumquat trees with thickened and elongated leaves, which also show stem-pitting particularly near the nodes. Tahiti lime is affected by a serious decline, associated with the presence of blotches on the leaves, necrotic grooves on the fruit, and necrotic streaks on twigs. The name 'blotch' is suggested for the condition, which was not graft transmissible to Key lime and other citrus varieties, though the blotch pattern frequently developed in new leaves of Tahiti scions on the test stocks. Blotch resembles descriptions of wood pocket or lignocortosis of lemon [cf. 34, p. 782] in California, not yet found in Florida.

At the Everglades Experiment Station C. C. Seale, J. F. Joyner, J. B. Pate, and T. E. Summers (pp. 249–250), in co-operation with the United States Department of Agriculture, observed two leaf spots of ramie (*Boehmeria* spp.). One (*Cercospora boehmeriana*) [*C. boehmeriae*: cf. 23, p. 410] was abundant in fields poor in vigour; the other, unidentified, occurred during excessively moist periods, and was controlled by spraying with dithane. In newly renovated fields and during dry weather many young plants were attacked by *Rhizoctonia* sp.

Inoculating the tips of 1 in. roots on Picardy gladiolus corms with *Fusarium oxysporum* f. *gladioli* [cf. 35, p. 368], R. O. Magie, at the Gulf Coast Experiment Station (pp. 273–275), found that in all cases the fungus grew into the base of the roots, but in no instance could it be isolated from the root traces in the corms at a depth greater than $\frac{1}{8}$ in. In another experiment with Picardy cormels it was shown that husking 3 weeks after harvest greatly reduced *Fusarium* infection in storage when coupled with N.I. ceresan treatment.

In inoculated cormels infection penetrated further on the husked than on the non-husked.

Cormel-sized pieces of diseased corm tissues kept for 30 min. in water at 132° F. were freed from infection by *F.o.* f. *gladioli*, *Curvularia lunata*, and *Stromatinia* [*Sclerotinia*] *gladioli* [cf. 35, p. 768]. Dormant cormels of the common commercial varieties (harvested after 1st May and treated 1–2 months later) were not damaged by a 30 min. treatment in water at 135°.

The most effective chemicals of 8 tested for the control of root infection of seedlings by *F.o.* f. *gladioli* were Mathieson 1439 (N-hydroxy-2-pyridine-thione), Monsanto CP 4367 [35, p. 369], Mathieson 1484 (pyridinethione, sodium salt), and Monsanto CP 9255 (2-aminoethanol pentachlorophenate). Flower dips were tested for the control of transit and storage rot (*Botrytis gladiolorum*) [cf. 36, p. 588] on freshly cut flower spikes of three gladiolus varieties; 1000 p.p.m. streptomycin+100 p.p.m. terramycin effectively checked infection.

In work on the control of soil rot of cucumber associated with *Rhizoctonia* [*Corticium*] *solani* [36, p. 632] G. Sowell and J. M. Walter found that a drench with tribasic copper and another with terraclor+captan were significantly superior to other captan treatments.

At the Sub-Tropical Station R. A. Conover reports (pp. 306–312) that sigatoka disease (*Cercospora musae*) [*Mycosphaerella musicola*] was very destructive in a commercial planting of Cavendish bananas; though the first report of the disease from Florida, it has probably been present for many years.

In an experiment on the control of tomato late blight (*Phytophthora infestans*) [cf. 36, p. 285], after 5 applications of zineb and streptomycin-terramycin (400–40 p.p.m.) the average number of lesions per 10 leaves was 0·5 and 1·4, respectively, as against 20 for the untreated.

T. W. Young (p. 318) reports that so-called 'soft nose' caused up to 10 per cent. loss of mature mango fruits, mainly at Palm Beach. The condition takes the form of an uneven ripening. Incidence and severity remained unaffected on Kent trees

sprayed with copper, zinc, manganese, and boron. Soft nose appears to be more prevalent in seedless than in seeded fruit.

At the Potato Investigations Laboratory A. H. Eddins and D. L. Myhre (pp. 330–331) stored healthy potato tubers and others affected by corky ringspot [spraing: cf. 34, p. 581], harvested in May, 1954, at four temperatures from 15th June to 7th Aug., 1954. The size and number of the lesions present in the affected tubers increased during storage. Symptoms of the disease also appeared in 70, 30, and 15 per cent. of the healthy tubers stored at 80°, 70°, and 60° F. respectively; none was seen in those kept at 90°. Soil in which the disease occurred had a higher pH, a lower organic matter content, and a lower moisture equivalent than non-infested soil.

Annual Report of the Agricultural Experiment Stations, Florida, for the year ending June 30, 1956.—351 pp., 37 figs., 16 graphs, [? 1957].

In the report from the Plant Pathology Section (pp. 112–118) H. H. Luke states that oat mildew (*Erysiphe graminis*) appeared in epidemic proportions at the North Florida Station, and new sources of resistance were selected, including C.I. 7155, C.I. 7156, C.I. 7158, C.I. 6977, C.I. 7125, AB 204, AB 206, AB 210, and AB 216. Studies of mutants resistant to blight (*Helminthosporium victoriae*) [cf. 35, p. 363] were continued. Wheat was seriously damaged in early spring by powdery mildew (*E. graminis*) and leaf and glume blotch (*Septoria tritici* [cf. 36, p. 389] and *S. nodorum* [cf. 33, p. 75]). An epiphytotic of mildew occurred in the north and west of the State. C.I. 13250 and C.I. 13232 were highly resistant, while P.I. 185833, resistant at Gainesville, was susceptible at Quincy, suggesting 2 different strains of the fungus.

C. W. Anderson studied five *Vigna-Crotalaria* viruses, four of which appear to be strains of the virus formerly known as cowpea mosaic virus [see preceding abstract]. One strain in some respects resembles Snyder's asparagus bean [cowpea] mosaic virus [21, p. 514], which with the cowpea strain of cucumber mosaic virus is seed-borne in cowpea. Both are transmitted by aphids, but not by the bean leaf beetle. Weed hosts of all five [chilli] pepper viruses [36, p. 677] found in central Florida were discovered. There is strong reason to believe that certain *Lespedeza* species, especially *L. striata*, may be among the most important primary hosts of tobacco etch virus. Among the primary sources of the chilli viruses are: *Physalis ciliosa* ([tobacco] etch and [potato virus] Y); *Solanum aculeatissimum* (the same + tobacco mosaic virus); *P. viscosa* and *Plantago virginica* (aster ring spot [tobacco ring spot virus], and the former also tobacco mosaic virus); possibly cowpea, *Scoparia dulcis*, and *Melothria pendula* (cucumber mosaic virus); and *Physalis elliotii* (tobacco mosaic virus). The annual species of *Solanum* yielded all five chilli viruses, but most commonly tobacco etch virus. No weed seems to be an important host of tobacco mosaic virus. *Indigofera hirsuta* and large bell hot [chilli] peppers proved useful indicators to distinguish the tobacco etch and potato Y viruses from potato virus A.

H. N. Miller reports that bacterial leaf rot of *Philodendron* spp. is caused by a closely related strain of *Erwinia chrysanthemi* [cf. 35, p. 511] designated var. *philodendri*. Used against [unspecified] bacterial leaf and stem diseases of [unspecified] ornamental plants, the antibiotics agrimycin 100 (in particular), streptomycin nitrate, and streptomycin sulphate were most effective when employed as protectant sprays at intervals of a week to 10 days. Diseases of foliage plants studied included a leaf spot of *Pilea cadierei* caused by a species of *Rhizoctonia*. Under 5 per cent. of nursery plants treated with vapam against [unspecified] damping-off and root rots became affected, as against 65 to 100 per cent. for all other treatments, including controls.

Further investigations were conducted by M. K. Corbett into the cause of 'grey wall' of tomato [cf. 36, p. 621], inoculations being made with a strain of tobacco

mosaic virus isolated from field-affected grey-wall plants. Of 1,279 fruits starting to turn colour, 172 showed vascular necrosis, and virus was recovered from 153. In uninoculated plots 19 fruits also showed vascular necrosis, but virus was not recovered from them. Of the fruits under shade 26 per cent. were affected, as against 7·8 per cent. of those unshaded. Further evidence indicated that vascular necrosis may be present with or without the presence of virus. There appear to be two types of symptom expression, one a mild external type affecting only one or two single vascular strands, from which virus may not always be recovered, the other consisting of severely affected fruits with many of the vascular strands necrotic, virus usually being recovered from them. Virus is not always obtainable from the foliage of plants with virus-infected fruit.

Lupin virus No. 1 [36, p. 806] was found to be a strain of bean yellow mosaic virus. Two strains were isolated from diseased lupins, differing in the reactions they caused, which were most noticeable on *Crotalaria spectabilis*. One strain causes local lesions on the inoculated leaves, with resultant necrotic systemic infection; the other produces only a strong chlorotic mottle. Lupin virus No. 2 [loc. cit.] was found to be a complex of two viruses or virus strains. One component appears to be a strain of the bean yellow mosaic virus. Lupin virus No. 3, isolated from *Lupinus angustifolius* grown at Tifton, Georgia, is very similar in host range and other properties to leguminous strains of cucumber mosaic virus.

Antiserum for tobacco mosaic virus was prepared, and a serological identification of tobacco mosaic virus strains is now possible. By using a micro-agglutination test developed in Holland it was possible to demonstrate a virus relationship between strains of bean yellow mosaic virus, the viruses affecting lupins, and a virus disease of cowpeas. It was also shown that lupin virus No. 1 and cowpea mosaic virus are strains of bean yellow mosaic virus.

H. N. Miller reports that complete eradication of a natural infection of sweet peas by powdery mildew [unspecified] was obtained by one application of anisomycin spray at 200 p.p.m. No infection developed on the new growth during one month, but severe flecking of the leaves resulted. Two applications at 100 p.p.m. gave only slight injury but were ineffective. Griseofulvin 100 p.p.m. sprayed three times at weekly intervals gave good control of powdery mildew [? *Erysiphe lagerstroemiae*] on crêpe myrtle [*Lagerstroemia indica*], while on roses similar treatment with anisomycin (100 p.p.m.) gave 85 to 95 per cent. control [of *Sphaerotheca pannosa*].

From the Central Florida Station (pp. 148–155) J. F. Darby states that in a fungicide trial on celery, started on 28th February, to control *Cercospora apii* [cf. 35, p. 808] 10 different weekly treatments were applied 14 times. The best control and yield were given as follows (in descending order of merit with dosages/100 gal.): ferbam (2 lb.); ziram (2 lb.); ferbam and maneb (1 lb. each); maneb (1·5 lb.); and cop-o-zink (4 lb.). In further celery seed-bed tests against [unspecified] damping-off and root rots [36, p. 631], an allyl alcohol-DD-formaldehyde formula at 40–40–150 gave significantly better results than the 25–40–100 formula, and 4½ gal. per acre of 83 per cent. emulsifiable EDB [ethylene dibromide] was satisfactorily substituted for DD. In addition, UF Concentrate-85, containing 25 per cent. urea and 60 per cent. formaldehyde, was as effective as 37 per cent. formaldehyde in equal amounts. Mixtures of allyl alcohol (40 gal./acre) and vapam (50 and 75 gal./acre) gave outstanding control. Flooding the soil for six weeks before transplanting, and spraying both lettuces and the surrounding soil a week after transplanting and after the final cultivation with ferbam (30 lb./200 gal. water/acre/application) reduced the incidence of drop (*Sclerotinia sclerotiorum*).

F[rancenia] E. Fisher reports from the Citrus Station (p. 169) high mortality of second and third stage purple scale insects (*Lepidosaphes beckii*) in June and July, due to *Myiophagus* sp. [cf. 34, p. 581] but sporadic rainy weather gave less effective

biological control than usual. *Hirsutella besseyi* caused high mortality of *L. beckii* crawlers and first stages during wet periods.

In studies by W. C. Price and L. C. Knorr (p. 193) on the rate, direction, and channel of movement of the viruses of tristeza and psorosis in Key lime and sweet orange seedlings [cf. 36, p. 316], both passed a graft union within 13 days. Neither has passed a girdled area on the main stem from above or below, but when virus passes across the graft union from the bud to a non-girdled stock it appears to be translocated rapidly, suggesting movement via the phloem.

E. F. Hopkins, K. W. Loucks, and A. A. McCornack report (pp. 197–199) that the control of post-harvest decay [unspecified] in citrus fruits with dowicide A-hexamine [cf. 35, p. 511] was again improved when oranges were stored at 60° F. instead of 70° and was most effective when this was combined with other treatments. In oranges treated with dowicide A-hexamine and packed in diphenyl cartons control amounted to 96 per cent. after 2 weeks at 70°, as against only 72 per cent. for the standard treatment. This combination was even more effective with fruit kept at lower temperatures. Even after 5 weeks at 60°, 94 per cent. control was obtained, and Pineapple oranges in cold storage for 10 weeks at 40° lost only 2·5 per cent. from decay, as against 36 per cent. in the untreated. Excellent control was given by a combination of the dowicide A-hexamine dipping treatment with the fungicidal water-wax 10 1 A, which contains dowicide A-hexamine, and was effectively combined with packaging in diphenyl containers.

L. C. Knorr and W. C. Price (pp. 208–209) indexed budwood into Key lime indicator plants from (1) squat disease of Meyer lemon, resulting in severe stunting and bushiness of affected trees; (2) corky collar of round kumquat (*Fortunella japonica*), a scrofulous callus roll at the bud union in trees budded on rough lemon rootstocks; (3) Idemor decline, a degenerative disease of the Idemor selection of Tahiti lime; (4) wood pit in citron etrog (*Citrus medica*), a pocking of the woody cylinder in the trunks of seedling trees; (5) X stunt in budded grapefruit trees, resembling Australian stunt-bush in appearance; (6) measles, a speckling of citrus foliage resembling the symptoms of mild boron toxicity; (7) sour-orange stunt, a depauperate condition of certain trees; (8) precocious bloom, an abnormality in Parson Brown sweet orange consisting of an off-season blooming of certain branches; (9) Cleo gnarl, a stunting of scions (particularly of Temple orange) on Cleopatra mandarin rootstocks, similar to that produced by xyloporosis virus, but unaccompanied by the deltoid type of wood pitting characteristic of the latter. Except for the first-mentioned disease, none of these abnormalities was associated with tristeza virus [cf. 36, p. 317], which was found in all the Meyer lemon trees tested, whether squat or not.

A leaf spot of *Sansevieria* caused by *Fusarium* sp. [cf. 35, p. 512] is reported from the Everglades Station by C. C. Seale, J. F. Joyner, J. B. Pate, and T. E. Summers (p. 228) to have become destructive in late winter and early spring. At 25° C. and over only small spots developed, between 15° and 20° the fungus sporulated profusely on infected leaves, causing larger spots to develop, and at 10° extensive damage was caused by secondary organisms entering through the *Fusarium* lesions.

From the Gulf Coast Station (pp. 252–276) C. M. Geraldson reports that during the autumn STEP 232 tomatoes developed a severe physiological disorder described as shoulder blotching or pitting. The crop was grown on virgin soil and yielded well. The injury was most severe at the first picking and almost disappeared by the third. It appeared regardless of pH differential. Spraying weekly with a mixture of boron and molybdenum before any injury appeared markedly reduced incidence, though neither calcium nor manganese had this effect. Soft fruit, more subject to breakdown, was found on plots with a pH of 6 to 6·6 more frequently than on those with a pH of 4·5 to 5. Both the boron plus molybdenum spray and the manganese spray reduced the prevalence and severity of this abnormality.

G. Sowell compared five fungicides applied 16 times at weekly intervals to tomatoes. Late blight [*Phytophthora infestans*] did not appear, but grey leaf spot (*Stemphylium solani*) was so severe [cf. 36, p. 431] that unsprayed plants became completely defoliated. Nabam+zinc sulphate, maneb, and zineb gave equally good control. Streptomycin at 200 p.p.m., applied immediately before each application of the above-mentioned fungicides, significantly reduced bacterial spot (*Xanthomonas vesicatoria*) [36, p. 603] on the fruit.

R. O. Magie (pp. 257–260) states that vapam, crag mylone, and terraclor were mixed in the row by rototiller at 100, 150, and 200 lb. per acre in a field heavily infested with *Stromatinia* disease of gladiolus [*Sclerotinia gladioli*]. Crag mylone was most effective in controlling root rot and gave the highest quality flowers; terraclor and crag mylone produced the heaviest corms.

Soil infested with *S. gladioli* was treated with vapam and crag mylone at 150 lb. of active ingredient per acre in tubs two weeks before being potted and planted with Picardy cormels. Half the soil was flooded immediately and half was kept moist during the two weeks. The weight of living plants was 6 to 7 times and of corms 2 to 3 times as great from the flooded as from the moistened soil. Flooding the soil for two months in summer was almost as effective as chemical treatment combined with flooding for two weeks, and treatment with vapam plus terraclor or crag mylone plus terraclor at 100 lb. of active ingredient per acre, mixed well with moist soil two weeks before planting, was as effective as flooding. Flooding of soil artificially infested with *Fusarium* cultures for up to two months had no effect, possibly owing to cool weather. In controlling *Fusarium* wilt [*F. oxysporum* f. *gladioli*], crag mylone at 100 and 200 lb. per acre was significantly better than vapam at the same concentration.

Mathieson 1456 at 250 p.p.m. and griseofulvin at 100 p.p.m. plus 0·01 per cent. triton X-100 significantly reduced day-old infections of flowers by *Botrytis gladiolorum* and protected unsprayed petals from infection when inoculated 2 to 6 days later. A 1 per cent. griseofulvin dust was effective as a field treatment when applied to tight buds 6 days before inoculation. Petals were not injured by these treatments until warm weather occurred.

A pathogenic bacterium, apparently *Xanthomonas phaseoli*, was isolated by G. Sowell (p. 274) from pole beans [*Phaseolus vulgaris*] with a severe leaf blight. A yellow bacterium, probably *X. vesicatoria* var. *raphani*, caused a locally prevalent leaf spot of turnips.

R. A. Conover from the Subtropical Experiment Station reports (p. 304) that excellent control of bacterial spot (*X. vesicatoria*) [cf. 36, p. 297] in tomato plant beds was obtained with agrimycin, agristrep, phytomycin, and floramycin, all at 200 p.p.m. of streptomycin, and was improved for seedlings by the addition of naphthyl acetamide or indoleacetic acid.

Report of the Rothamsted Experimental Station for 1956.—280 pp., 1 pl., 1 map, 1957.

Reporting on the work of the Plant Pathology Department (pp. 98–120) [cf. 35, p. 866], F. C. Bawden states that analyses of the strain of tobacco mosaic virus which affects French bean [*Phaseolus vulgaris*] systemically showed the presence of histidine in the preparations from beans and its absence from preparations from tobacco. In tobacco plants inoculated with the virus from beans and grown at over 30° C., the usual tobacco form was not produced; the virus had the pathological and serological qualities of the bean form, and contained histidine.

F. C. Bawden and A. Kleczkowski (pp. 99–100) summarize studies on the electrophoretic patterns of sap from normal and virus infected leaves and A. Kleczkowski reports on the antigenic components of preparations of tobacco mosaic virus [36, p. 669].

H. L. Nixon studied electromicroscopically the multiplication of tobacco mosaic virus in inoculated leaves [cf. 36, p. 428], and particularly the changes occurring immediately after inoculation. Apparently, virus particles in the inoculum have three possible fates, distinguishable by the amount of washing necessary to detach them: (1) they may remain unaffected by any washing; (2) they may become protected against a brief wash in running water, but not against prolonged soaking; (3) they may be detachable by a brief rinse in running water. Only particles of the first type are likely to infect and multiply, and these are most easily studied in leaves floated in water immediately after inoculation. The proportion of the rods of type 1 immediately after inoculation appeared to be about 0·2 per cent. at 25° and 5 per cent. at 35°. The scatter diagram of particles suggests that their length for each virus is variable and is determined chiefly by mechanical factors.

B. Kassanis reports that strains of one virus may differ in their ability to multiply at 36°. At least one strain of cucumber mosaic virus infects and multiplies in plants kept at 36° and the accumulation of tobacco mosaic virus in tobacco plants at 36° varies with the strain and with the identity of the host plant.

During the year a line of Arran Victory potato free from potato virus S [potato paracrinkle virus (str.): 35, p. 868] (present in all previously existing lines) was produced by apical culture, grafting to tomato, and final rooting.

It was shown that the protein content of cultured tumour tissue [unspecified] is less than that of systemically infected leaf sap, as also is the virus content (about $\frac{1}{25}$, apparently, whether or not the tissues are actively growing). Although without a cuticle the tissues do not become infected by tobacco mosaic virus unless wounded. Spread through inoculated cultured tissue took place at about 1 mm. per week. No plasmodesmata could be detected therein by methods indicating them in leaf cells, and their suggested rôle as the route of virus cellular spread seems doubtful.

T. W. Tinsley identified five distinct viruses in leguminous plants. Broad-bean mottle virus [31, p. 469] was found in field [broad] beans in Cambridge. The most prevalent virus in field beans was pea mosaic, but pea leaf roll virus [cf. 35, p. 144], a new record for Great Britain, occurred frequently in peas and field beans and seems to be widely distributed. Occasionally it was transmitted between peas and field beans by *Macrosiphum pisi*. Bean yellow mosaic virus [cf. 35, p. 868] also appears to be widespread. It occurs in many strains differing in virulence, and though not found in cultivated clovers is present in most of those on waste land near Harpenden. Lucerne mosaic virus [cf. 36, p. 420] was very prevalent in lucerne more than two years old.

J. T. Slykhuis, Marion A. Watson, and T. Mulligan distinguished three viruses in grasses and cereals in addition to barley yellow dwarf [36, p. 520]: barley false stripe or stripe mosaic [cf. 36, p. 464]; a previously undescribed one causing a streak mosaic of ryegrass (*Lolium perenne* and *L. multiflorum*); and one producing a disease of wheat closely resembling striate mosaic [cf. 33, p. 417]. Symptoms and tests indicated the presence of barley stripe mosaic virus in the variety Gloire du Velay, growing in Cambridge from French seed. *L. perenne* and *L. multiflorum* in many parts of England, Wales, Scotland, and Holland bore chlorotic streaks on the leaves and sometimes had brown, necrotic leaves. In thick stands of perennial ryegrass there was little damage apparent, but in widely spaced plants there was a striking decrease in growth. The virus appeared to be transmitted by mites, but not by aphids or other insects found on the plants. The wheat mosaic was found to be caused by a virus transmitted by *Delphacodes pellucida*. The insects do not transmit until 8–16 days after first feeding on infected plants, and if then ceasing to feed remained able to transmit for more than two months. The initial symptoms, thread-like chlorotic spots and streaks, appear two to three weeks after infection; plants infected before tillering usually die. Barley, oats, and perennial and Italian

ryegrass were also susceptible. Preliminary tests in the glasshouse suggested that different grasses and strains of grasses may differ in susceptibility to barley yellow dwarf. In a field experiment with wheat, oats, and barley there were considerable differences in yield between infected and uninfected plants, and as a rule losses increased with earliness of infection, amounting in barley to 25 and 8 per cent. in early and late infections, respectively.

J. W. Blencowe and L. Broadbent found a new virus in crinkle-infected turnips, having spherical particles of about the same size as those of the crinkle virus [cf. 35, p. 869], though the two are not related serologically and can be separated by differential precipitation with ammonium sulphate. The new virus was recently found alone, infecting turnips in Kincardineshire.

Further experiments by T. Mulligan confirmed that *Myzus persicae* is most effective as a vector of cabbage black ring spot virus [36, p. 506] when first starved and then fed for only 2 min. on infected plants; cauliflower mosaic virus [loc. cit.] is transmitted only little more frequently by aphids given this treatment than by aphids allowed to feed for 24 hr. on infected plants. Experiments with leaves irradiated with ultra-violet light, which almost prevented the transmission of the black ring spot virus but had little effect on cauliflower mosaic virus, suggested that the two may be differently distributed in infected leaves.

L. Broadbent and G. D. Heathcote continued their work on the control of potato virus diseases by insecticidal spraying [36, p. 53]. The resorcin blue test was applied to 250 tubers from a diseased stock of King Edward [cf. 35, p. 540] before planting. Leaf roll was correctly indicated in 66 per cent. of the infected plants, but 42 per cent. of those that reacted positively failed to show the disease, while 6 per cent. of the tubers which did not react gave infected plants.

R. Hull and D. H. Firth state that beet yellows virus [cf. 36, p. 442] can be controlled by raising stecklings under cover crops. An experimental beet crop raised under a barley cover-crop contained no plants with yellows. R. Hull continued the testing of 150 inbred progenies selected for tolerance; some, self-pollinated for a second time, had vigorous, green leaves when infected in the field. In another experiment, plants inoculated in the field simultaneously with mild and virulent isolates were less stunted and yellow than when infected with either isolate alone.

J. W. Blencowe made a detailed study of the distribution of diseases in 140 beet and mangold crops, totalling about 2,000 acres, in Suffolk, to determine whether spread occurred from wild beet on the shore, and found that all fields containing more than 1 per cent. of plants affected by beet mosaic virus or downy mildew (*Peronospora schachtii*) were within 1,000 yards of the foreshore. In some fields adjoining the foreshore almost all the plants had beet mosaic virus, but there was a steep gradient of infection, and 100 yards inland under 10 per cent. of the plants were infected. Beet yellows virus was generally more severe in this and the adjoining peninsulas than in much of the remainder of East Anglia, and some fields had almost 100 per cent. infection by mid-August. Losses from yellows in the 1,400 acres of sugar beet in this area were estimated to amount to at least 2,800 tons of beet. In these areas routine insecticidal spraying and herbicide destruction of wild beet is recommended.

R. S. Badami reports that a strain of cucumber mosaic virus obtained ten years ago from naturally infected spinach and readily transmitted by *M. persicae* up to 1954 is no longer so, though other strains of cucumber mosaic similarly maintained are [cf. 36, p. 551].

In the report of the Biochemistry Department, N. W. Pirie (p. 94) states that in studies with F. C. Bawden he found that the mitochondrial fraction from tobacco leaves infected with tobacco necrosis virus [cf. 35, p. 579] contains a system that, *in vitro*, robs purified virus of its infectivity. The material responsible diffused

through cellophane and withstands drying and boiling. It is probably made continuously by an enzymic process. Extracts are ineffective anaerobically or if the mitochondria have been heated, frozen, or exposed to chloroform, or in the presence of leaf sap. Mitochondria from uninfected leaves also inactivate, but much less strongly; those from leaves infected with tobacco ring spot virus inactivate both necrosis and ring spot viruses, but none of these preparations affects tobacco mosaic virus.

G. H. Wiltshire (p. 95) records that in 69 tests of the effect of darkening on the susceptibility of French beans [*Phaseolus vulgaris*] to infection with tobacco necrosis virus [36, p. 169] there was an increase in 48 and a reduction in 21 tests. Some of this variability may be ascribed to differences in season and weather, and particularly to differences in illumination and temperature. There was generally an inverse relation between carbohydrate content and susceptibility in comparisons of older and younger plants on the same day, summer- and winter-grown plants, and control and darkened plants. Covering the underside of the leaf with gum to block the stomata reduced susceptibility but increased the water content. It was not possible to increase the carbohydrate of leaves on the plant by more than 20 per cent. by infiltration of sugars. Infiltration of sucrose with potassium phosphate for three days before inoculation reduced the susceptibility of darkened leaves, but did not affect that of illuminated leaves. Sucrose alone had no effect. It seems likely that susceptibility depends, in part, on the content of some photosynthetic product. It is not directly related to the carbohydrate content, on which infiltration of 2-4-dichlorophenoxyacetic acid, though reducing the susceptibility of darkened leaves, exerted little effect. Plants kept at 24°, 30°, or 36° before inoculation were more susceptible and contained less carbohydrate than others in the uncontrolled greenhouse at 8°–38°. It seems that the temperature and illumination factors interact, giving a daily fluctuation of susceptibility.

In the Mycology section (pp. 111–120), J. M. Hirst and O. J. Stedman, studying further the early phases of potato blight [*Phytophthora infestans*: cf. 35, p. 871], inoculated 300 tubers of each of three potato varieties in December 1955, and planted them in April 1956 among healthy plants. Six of the Ulster Cromlech tubers and one each of Majestic and King Edward produced stem lesions originating underground. The first two were noted on 12th June and others appeared at intervals up to 3rd July. Sporangial infections nearby were first found on 19th June, and of nearly 2,000 plants 92 per cent. were infected by 24th July. Blight was first observed on commercial crops in the locality on 1st August. When potted potato plants were left unprotected and exposed to sporangia from all routes while others were caged so as to protect them from contact with leaves and from leaf drip water, but only slightly to obstruct the arrival of dry sporangia or those borne in splash droplets, after 24 hours' exposure the protected plants had 40 per cent. as many infections as the unprotected.

G. A. Salt, in a further attempt to ascertain whether skin spot on potato tubers could be caused by isolates of *Oospora pustulans* [36, p. 720] from potato roots, dipped 50 tubers of each of six varieties in spore suspensions four days after lifting, the tubers then being stored. In the spring 16 per cent. of the undipped tubers and 25 and 29 per cent. of those inoculated with isolates from roots and tubers, respectively, had skin spots. Infection of eyes or sprouts by *O. pustulans* appears to be much more prevalent and important than skin spot; 30 per cent. of the dormant eyes cut from washed Majestic tubers soon after lifting produced conidiophores when incubated for five days at 18° in a humid atmosphere. Tomato seedlings grown in pots of soil from different fields became infected with *O. pustulans* though one field had not grown potatoes for ten years. The disease rating of six maincrop varieties examined in mid-August was found to be correlated with seed infection at planting. Of the fungicides tested none showed promise of controlling the browning

symptoms or of increasing yield. The incidence and severity of the symptoms on roots and stolons were reduced by a combined application of 10 per cent. thiram dust to the seed tubers and in the furrow at 100 lb. per acre but by neither alone. In culture on solid and liquid potato dextrose media *O. pustulans* grew best at 16° while there was little or no growth at 0° or 24°.

J. M. Hirst and O. J. Stedman report that differences in ascospore production by *Venturia inaequalis* [cf. 35, p. 777] were not necessarily associated with varieties or districts, for leaf samples in the Wisbech area differed by factors of 1,000 in their ascospore content. Spraying the ground with 500 gal. of 0·1 per cent. sodium DNOC [DNC: cf. 35, p. 422]/acre in March decreased by 92 per cent. the number of ascospores liberated from dead leaves.

E. W. Buxton found that of nine English pea varieties growing in a wilt-sick soil in Essex only Kelvedon Triumph and Harrison's Glory were resistant to *Fusarium oxysporum* [f. *pisi*: cf. 36, p. 629]. Adding DBNP (2:4-dinitro-6-*sec*-butylphenol) herbicide to inoculated soils in pots before planting peas decreased wilt by 70 per cent., but applications after peas had grown for four days in such soil were ineffective. Only 8·6 per cent. of all *F. oxysporum* f. *pisi* isolates obtained by direct soil-plating from wilt-sick soil were pathogenic towards Alaska and Delwiche Commando, the differential hosts for races 2 and 3, respectively. Over 80 per cent. of the isolates from the roots of diseased Onward peas grown in infested soil infected Onward. Centrifuging water suspensions of soil and plating out the supernatant fluid increased the numbers of *Fusaria* isolated. In another experiment, only 5 per cent. of the spores of *F. o.* f. *pisi* germinated in inoculated Rothamsted soil extract, 17 per cent. in wilt-free Essex soil extract, and 61 per cent. in wilt-sick Essex soil extract. Comparable figures for *F. solani* [f. *pisi*] were 4, 14, and 8 per cent. respectively. A further study was made of the rhizosphere populations and root exudates from pea varieties with different susceptibilities to three physiologic races of *F. o.* f. *pisi* [loc. cit.]. Onward, susceptible to race 1, had more fungi, bacteria, and actinomycetes near its root surfaces than Alaska or Delwiche Commando, resistant to race 1. Rhizosphere populations changed quantitatively and qualitatively as the plants aged, and were usually maximal after 14 days. Qualitative differences between the three varieties were most obvious in *Fusaria* and bacteria, but Mucorales, *Trichoderma*, *Penicillium* spp., and *Gliocladium* were more abundant in the rhizospheres of plants resistant to race 1 than in Onward. The evidence obtained indicated that roots of pea varieties resistant to *F. o.* f. *pisi* either secrete substances that prevent race 1 spores from germinating or stimulate the production of a soil microflora exerting this effect.

Wilt (*F. o.* f. *melonis*) [cf. 34, p. 630] killed 70 per cent. of the cantaloupe melons (variety Tiger) in a commercial garden at Chorley Wood, Hertfordshire, in August 1956. Lucerne wilt, not recognizable as that due to *Verticillium* [*albo-atrum*: 32, p. 629], was first noted on 2nd July in Essex, where affected plants occurred along the edge of a patch of wilted peas. A similar disease affected lucerne at Rothamsted in August.

Mary D. Glynne describes further work on eyespot of wheat (*Cercosporella herpotrichoides*) and with D. B. Slope details an experiment showing that responses of wheat to various agricultural treatments depend partly on the incidence of eyespot and take-all (*Ophiobolus graminis*) and that the responses need to be measured both on land free from and infested with these diseases. G. A. Salt deals with eyespot and take-all of wheat at Rothamsted in relation to the ley-arable rotation experiment.

I. Macfarlane, working with F. T. Last, found that the retardation of club root of cabbages (*Plasmodiophora brassicae*) when griseofulvin was sprayed on to the foliage was not caused by translocation of the material after absorption through the leaves but by absorption through the roots of griseofulvin which had reached

the soil. No changes in the dry weight of the various organs or in any other quantity were detected until the roots were visibly clubbed; differences between healthy and diseased plants began when the gall was initiated and increased as it grew. There were fewer, smaller, and thinner leaves on diseased than on healthy plants. Spore germination in *P. brassicae* was affected by the treatment of the sample during storage and by secretions of the roots of the host plants. When spores were stored at 4° in dilute suspension their ability to germinate and cause infection was sometimes reduced, suggesting that a factor necessary for germination can be leached from them. Germination was expedited and the proportion of germinating spores increased by the presence of host plants or by incubation in diffusates from the roots of host plants.

C. E. Cornford reports that a spray containing 1 per cent. streptomycin and 1 per cent. glycerol effectively controlled downy mildew (*Peronospora schachtii*) on beet seedlings in the greenhouse. Oospores were found in 35 of 193 infected leaves from Lincolnshire and Norfolk in September and October. R. Hull records that insecticidal seed dusts containing gamma-benzene hexachloride increased seedling emergence from beet seed sown in July at Dunholme, but after singling proved extremely phytotoxic. In experiments by L. F. Gates, addition of soil fungicides to rows sown with beet seed treated with ethyl mercury phosphate increased emergence by 3·5 per cent. E. W. Buxton isolated several fungi from the roots of plants with 'docking disorder'. Of eight fungal species inoculated to beet seedlings in pots of John Innes compost adjusted to three pH levels, 5·3, 6·5, and 8, only *F. oxysporum* and *Pythium* sp. caused damage. Symptoms were more pronounced in acid than in alkaline soil.

In the Report of the Insecticides and Fungicides Department A. H. McIntosh (pp. 145–147) states that the slide-germination method for testing fungicides *in vitro* was used with Böttcher's slides enabling drops of spore suspensions to be kept for up to three days. It was found that the optimum temperature for the germination of *Botrytis fabae* is 25°, but the percentage of spores which germinated was scarcely affected by temperature within the range 10° to 25°. The effects of temperature on toxicity appeared to be much more important than those of time. The following had positive coefficients of toxicity between 25° and 10°: *n*-butyl alcohol (3·1 in 24 hr.), *tert*-butyl alcohol (3 in 24 hr.), mercuric chloride (6 in 24 hr.), and mercuric bromide (3·4 in 24 hr.). All these were most toxic at the optimum temperature for germination. The toxicities of the following were almost independent of temperature in the same range: 8-hydroxy-quinoline sulphate, sodium pentachlorophenate, phenyl mercuric acetate, acetic acid, copper sulphate, silver nitrate, and mercuric acetate. F. T. Last found that with increasing age of culture, the ability of *B. fabae* conidia to infect the leaves of *Vicia faba* was lost more rapidly than their ability to germinate on glass slides. Though 80 per cent. of conidia from 40 day-old cultures germinated, only 10 per cent. from 20 day-old cultures could cause infection.

Reporting on the work of the soil Microbiology Department (pp. 71–75), H. G. Thornton notes that there is evidence of a fungistatic substance (or substances) [cf. **36**, p. 486], destroyed by heat, that inhibits spore germination in soil. R. M. Jackson found that soils from differently manured plots inhibited germination of *Penicillium* conidia in varying degree and that species of fungi differed in their sensibility to this effect.

Pot experiments by H. H. Mann and T. W. Barnes suggest that 'sick' clover soils result from the presence of a toxic substance, and addition of 10 per cent. animal charcoal to such soils results in normal growth of clover. Margaret Brown and E. A. Peterson found that plated rhizosphere soils contained bacteria resistant to streptomycin, especially from older plants and clover-sick soil. Aureomycin controlled bacterial growth in the plates without affecting the fungi.

Also obtainable from the

COMMONWEALTH MYCOLOGICAL INSTITUTE

COMMONWEALTH PHYTOPATHOLOGICAL NEWS

A quarterly giving news and views of current phytopathological matters in the Commonwealth. Annual subscription 5*s*. post free. Single numbers 2*s*. 6*d*.

INDEX OF FUNGI (formerly SUPPLEMENTS TO THE REVIEW OF APPLIED MYCOLOGY)

Published twice yearly. Subscription 10*s*. per annum.

Vol. 1 Index and Title-page, 25*s*.

Vol. 1 bound complete with Index, price £5. 15*s*.

Vol. 1, parts 1 to 20, and Vol. 2, parts 1 to 14, 5*s*. each.

PETRAK'S LISTS of new species of fungi reprinted from Just's *Botanischer Jahresbericht* for 1920–39 with INDEX PARTS 1 and 2 now available. Prices on application.

DISTRIBUTION MAPS OF PLANT DISEASES

A SERIES of maps showing the world distribution of major plant diseases is now being issued at the rate of two maps each month. New maps and new editions of maps are published periodically. The subscription price is 7*s*. 6*d*. per annum, post free. Back issues, in series, 5*d*. each; odd numbers 9*d*. each, postage extra. Loose-leaf binders for the maps are now available, price 20*s*., postage extra. Maps 1 to 350 available to the end of 1957.

MYCOLOGICAL PAPERS

No. 61. THE GENUS CEREBELLA. By R. F. N. LANGDON. 18 pp., 2 pl., 6 figs., 1955. 7*s*.

No. 62. A REVISION OF THE BRITISH HELOTIACEAE IN THE HERBARIUM OF THE ROYAL BOTANIC GARDENS, KEW, WITH NOTES ON RELATED EUROPEAN SPECIES. By R. W. G. DENNIS. 216 pp., 1 pl., 179 figs., 1956. 60*s*.

No. 63. PRELIMINARY LIST OF PLANT DISEASES IN NORTHERN RHODESIA. By E. A. RILEY. 28 pp., 1 map, 1956. 9*s*.

No. 64. USTILAGINALES OF WEST PAKISTAN. By S. AHMAD. 17 pp., 8 figs., 1956. 6*s*.

No. 65. SOME SPECIES OF CORYNESPORA. By M. B. ELLIS. 15 pp., 8 figs., 1957. 6*s*.

No. 66. SOME SPECIES OF DEIGHTONIELLA. By M. B. ELLIS. 12 pp., 6 figs., 1957. 5*s*.

No. 67. HAPLOBASIDION, LACELLINOPSIS, AND LASCELLINA. By M. B. ELLIS. 15 pp., 9 figs., 1957. 6*s*.

No. 68. STUDIES OF PYRENOMYCETES: I. FOUR SPECIES OF CHAETOSPHAERIA, TWO WITH CATENULARIA CONIDIA. II. MELANOPSAMMA POMIFORMIS AND ITS STACHYBOTRYS CONIDIA. By C. BOOTH. 27 pp., 7 figs., 1957. 9*s*.

No. 69. SOME SPECIES OF TERATOSPERMA. By M. B. ELLIS. 7 pp., 5 figs., 1957. 3*s*.

PHYTOPATHOLOGICAL PAPERS

No. 1. LOSSES CAUSED BY PLANT DISEASES IN THE COLONIES. By G. WATTS PADWICK. 60 pp., 28 figs., 1956. 10*s*.

No. 2. WITCHES' BROOM DISEASE OF CACAO. By R. E. D. BAKER and PAUL HOLLIDAY. 42 pp., 14 plates, 10 figs., 1957. 12*s*. 6*d*.

Numbers are issued at irregular intervals. Until further notice a rebate of 33⅓ per cent. is allowed on new Papers to those who register for all numbers as issued, the charge to subscribers to the *Review of Applied Mycology* being added to their subscriptions for the succeeding year, others being billed annually. A binding-case for Mycological Papers 1–25 is now available, price 5*s*., postage extra.

THE REVIEW OF APPLIED MYCOLOGY

THE subscription to the *Review* for the current volume is 70*s*. per annum, post free, payable in advance. Back volumes can be supplied, but the price is 80*s*. per volume, postage extra, with the exception of a few parts, which are out of print. Microfilm copies of the volumes out of print can be supplied to order.

ALL publications are post free and, with the exception of Mycological and Phytopathological Papers, all subscriptions are payable in advance. Foreign subscribers should pay by International Money Order or through the British Agents of their Bankers. Orders and correspondence should be addressed to the DIRECTOR, COMMONWEALTH MYCOLOGICAL INSTITUTE, FERRY LANE, KEW, SURREY.

CONTENTS

AUTHORS' NAMES

Allington, 756
Andrén, 781, 784, 802
Anzalone, 764
Arny, 757
Atkins, 787
Bachmann, 792
Bagnall, 779
Barham, 793
Bartels, 790
Barton, 802
Basham, 798
Baskett, 768
Bazzigher, 796
Becker, 801
Benda, 790
Bental, 760
Berbee, 795
Bieber, 753
Binot, 763
Bird, 761
Bitancourt, 760
Blodgett, 769
Bolland, 799
Boone, 767
Brandenburg, 804
Braun, 757
Bremer, 765, 774
Brierley, 763
Bulit, 767
Butler, 774
Bystricky, 789
Carmichael, 800
Carter, 770
Casarini, 772
Chase, 787
Christensen, 755
Daines, 770
Dedic, 778
Dickson, 756
Dimond, 774
Duddington, 773
Dulaney, 778
Edward, 765
Epps, 785
Evatt, 787
Fischer, 774
Fisher, 759
Gammon, 790
Garrett, 787
Gattani, 787
Gäumann, 791, 792, 796
Geraldson, 793
Graf, 803
Gray, 770
Green, 786
Greene, 788
Gregory, 776
Gualaccini, 770
Gustavsson, 754
Guyot, 789
Hardenburg, 768
Haskins, 776, 778
Hassebrauk, 754
Heim, 788
Henke, 803
Hey, 781
Higdon, 768
Hildebrand, 786
Hinke, 754
Hiratsuka, 763
Horsfall, 774
Huffman, 754
Hunt, 766
Hussein, 761
Iverson, 797
Izrail'sky, 793
Jacquet, 757
Johnson (H. W.), 766
Johnson (J. C.), 805
Johnston (A.), 771
Johnston (C. O.), 754
Jones, 795
Joshi, 793
Kandaswamy, 765
Karpovskaya, 793
Kaul, 754
Keitt, 767
Kern, 791
Kincaid, 790
Kluepfel, 791
Koch, 778
Köhler, 779, 781
Kreitlow, 766
Krexner, 803
Kuhnholtz-Lordat, 773
Lafon, 759
Larson, 779
Latterell, 786
Leben, 757
Levisohn, 798
Lihnell, 785
Lockard, 787
Lohwag, 800
Mallinjoud, 771
Martini, 801
Maynard, 793
McClean, 759
McClellan, 764
McCombs, 793
McKay, 753
McWhorter, 764, 805
Meinecke, 777
Mende, 766
Messiaen, 759
Miles, 758
Mischke, 762
Montant, 764
Moreau, 762
Mulder, 778
Müller (H.), 773
Müller (H. W. K.), 771
Müller (K. O.), 773, 782
Murray, 799
Myers, 789
Naeff-Roth, 792, 796
Naim, 761
Naumova, 765
Naylor, 790
Nordin, 800
Nelson, 771
Neufeld, 786
Newmark, 789
Olofsson, 781, 784
Pady, 775
Panzer, 775
Paquin, 792
Parker, 798
Patterson, 756
Peace, 797, 799
Plakidas, 764
Popov, 801
Powers, 755
Pringle, 757
Rademacher, 774
Raeuber, 782
Ramage, 754
Ramsey, 770
Ranney, 761
Reichert, 760
Reitberger, 802
Richards, 778
Roth, 800
Ryall, 768
Sando, 755
Sanwal, 791
Săvulescu, 789
Saxena, 793
Scheffer, 790
Schimitschek, 761
Schmidle, 769
Schmiedeknecht, 766, 784
Schneider, 804
Schöller, 778
Schwerdtfeger, 795
Scurti, 800
Shands, 756
Sharp, 776
Shemahanova, 777
Siegelman, 768
Skoropad, 757
Smerlis, 797
Smith (F. F.), 763, 764
Smith (F. G.), 776
Smith (F. H.), 805
Smith (G. E.), 791
Smith (M. A.), 770
Smock, 768
Sommer, 802
Staples, 756
Stepanova, 765
Stevenson, 787
Stewart, 760, 766
St. Garay, 758
Stille, 777
Stoeckeler, 795
Sundaram, 765
Suneson, 754
Tarr, 788
Taylor, 764
Travis, 763
Trione, 800
Tsuimbal, 758
Tuite, 755
Tupenevich, 803
Tyner, 756
Tullis, 775
Ullstrup, 758
Uota, 768
Vaartaja, 795, 798
Valenta, 781
Van Arsdel, 775
Venkata Ram, 778
Verderevski, 758
Voitovich, 758
Volger, 797
Walker, 773, 779
Wartenberg, 753
Watkins, 761
Waygood, 792
Weintraub, 786
Wellman, 760
Wenzl, 803, 804
Wetter, 780
White, 775
Whitehead, 776
Wiederspahn, 768
Wilkins, 766
Yearsley, 801
Zeck, 783
Zuckerman, 797

SUBJECT INDEX

Antagonism, 775
Antibiotics, 787, 798
Bacteria, 753, 770, 772, 784–6, 805
Diseases and disorders of:
  Apple, 767–8
  Cereals, 753–9
  Citrus, 759–60
  Coffee, 760–1
  Cotton, 761
  Flowers and ornamentals, 762–6
  Fruit, 767–72
  Herbage crops, 766–7
  Insects, 761
  Pineapple, 771–2
  Potato, 779–86
  Rice, 786–7
  Spices, 787
  Sugar beet, 802–5
  Tobacco, 789–801
  Tomato, 790–3
  Trees and timber, 793–801
  Vegetables, 801–5
Fungicides, 772
General publications, 773–6
Industrial and officinal fungi, 758
Lists of fungi or diseases, 788–9
Mycorrhiza and symbiosis, 777, 798–9
Physiology, 774, 776–9, 802
Reports from Florida, 805, 808; Forest Research, Great Britain, 793; Germany, 753; Rothamsted, 811–16
Soils and fertilizers, 787
Systematic mycology, 788–9
Technique, 775–6
Virus diseases, 754, 756, 759, 760, 762–763, 766, 770, 779–81, 786, 789–90, 795–6, 801, 802–3, 805

THE Executive Council of the Commonwealth Agricultural Bureau is a signatory to the Fair Copying Declaration, details of which can be obtained from the Royal Society, Burlington House, London, W.1.

© *Commonwealth Agricultural Bureaux, 1957*